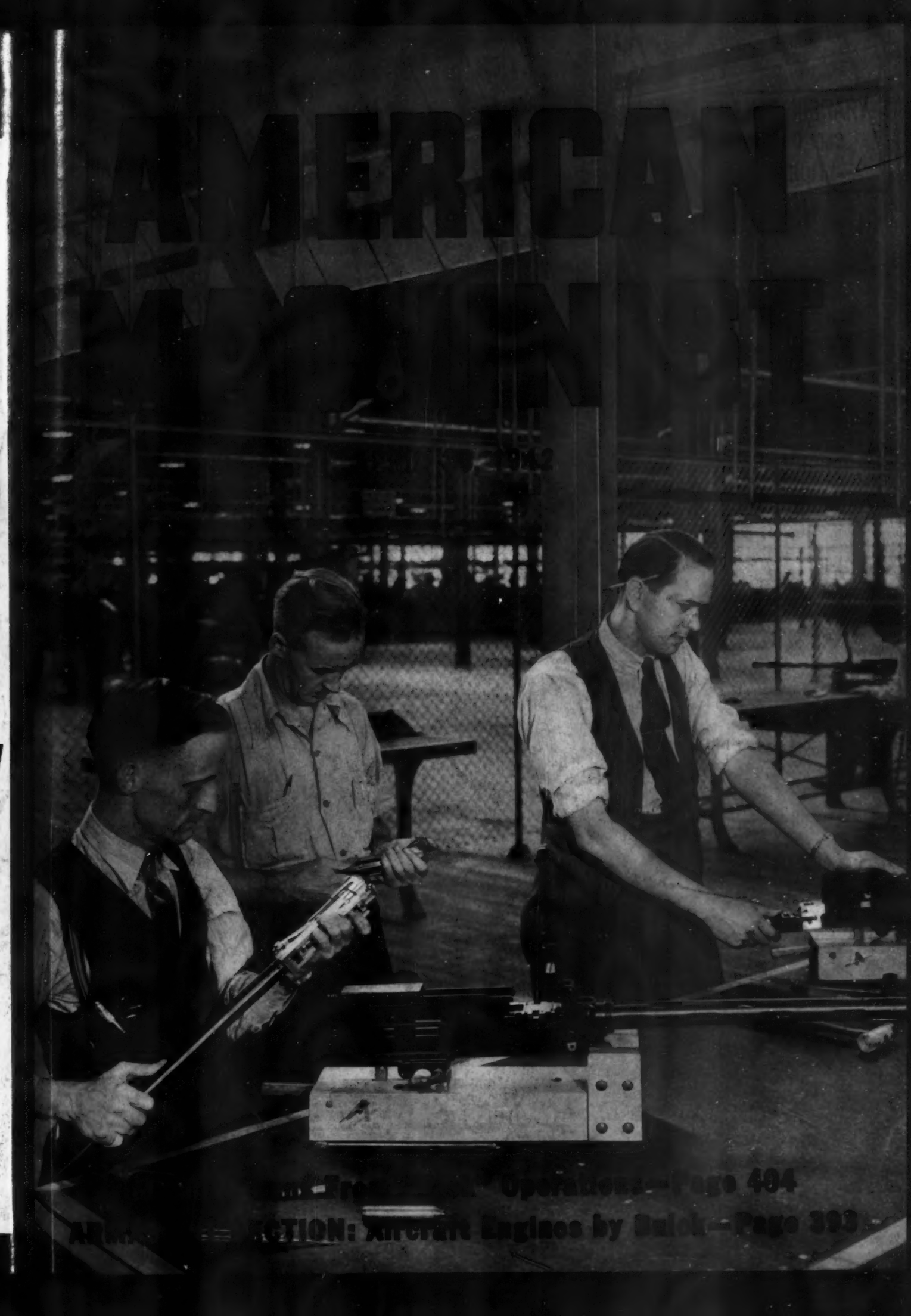

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Heald Saves

FLOOR SPACE
★
MAN POWER
★
COST OF EQUIPMENT

The following is torn from a National Machine Tool Magazine

The machining of the twenty trunnions that project from the face of reduction gear carrier rings is now performed on Heald "Bore-Matics" equipped with two cutting heads in the manner shown above. The parts are loaded on an indexing head, which advances by a rapid hydraulic movement to the feed position. Two diametrically opposite trunnions are then fed into tungsten-carbide tipped, adjustable-blade hollow mills which turn the outside diameter and face the shoulder. When finished, the work-head withdraws and indexes automatically to bring the next two trunnions in line with the cutters. When the twenty trunnions have thus been turned and faced, the machine automatically stops while the part is unloaded. Two of these machines take the place of eleven single-spindle drill presses. The saving in man power amounts to twenty-seven men a day, while the saving in machine costs amounts to almost eight times the cost of the two machines.

THE ABOVE IS ONLY ONE OF THOUSANDS OF JOBS WHERE HEALD ENGINEERS HAVE MET THE PRESENT DAY DEMANDS FOR METHODS AND MEANS OF SPEEDING PRODUCTION

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

AMERICAN MACHINIST

April 30, 1942

Automatic Guns—Carefully planned operations enable a Canadian plant to use unskilled workers on precision work

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y., Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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AMERICAN MACHINIST. Copyright 1942 by McGraw-Hill Publishing Co., Inc. Published every other Thursday, price 35c a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates — United States, Canada, Mexico and Central and South American countries $5.00 a year, $8.00 for two years, $10.00 for three years. All other countries $8.00 a year, $13.00 for two years, $16.00 for three years. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

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PRINTED IN U. S. A.

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AMERICAN MACHINIST

"MOTOR CARS to MUNITIONS"

Number

Every executive in Metal-Working is watching the steps by which automotive plants are being converted to armament production—because many of them are soon to follow suit. This important and timely issue will tell WHAT the automotive world is doing . . . HOW and WHEN it is being done. (Within censorship limits). It will be a valuable addition to the *American Machinist* Armament data which over 100,000 readers are using as a practical text for munitions production—*and a handbook on conversion for all Metal-Working.*

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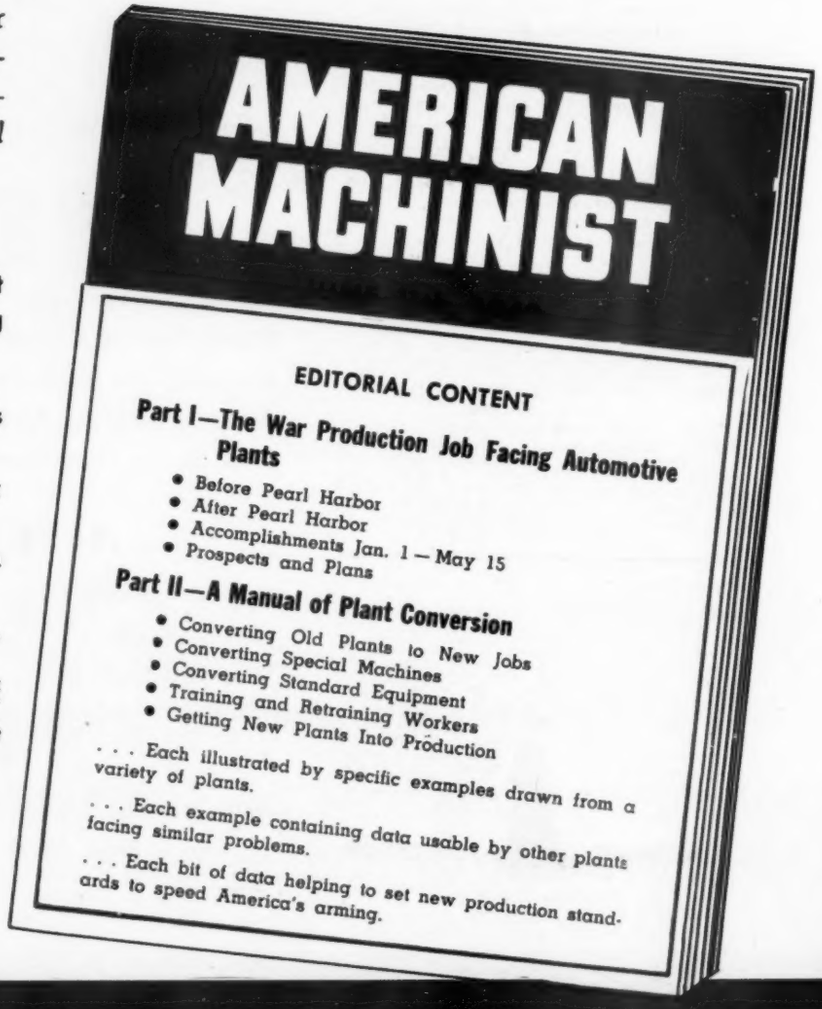
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TEETH OF BEVEL AND HYPOID GEARS PRECISION GROUND ON THIS

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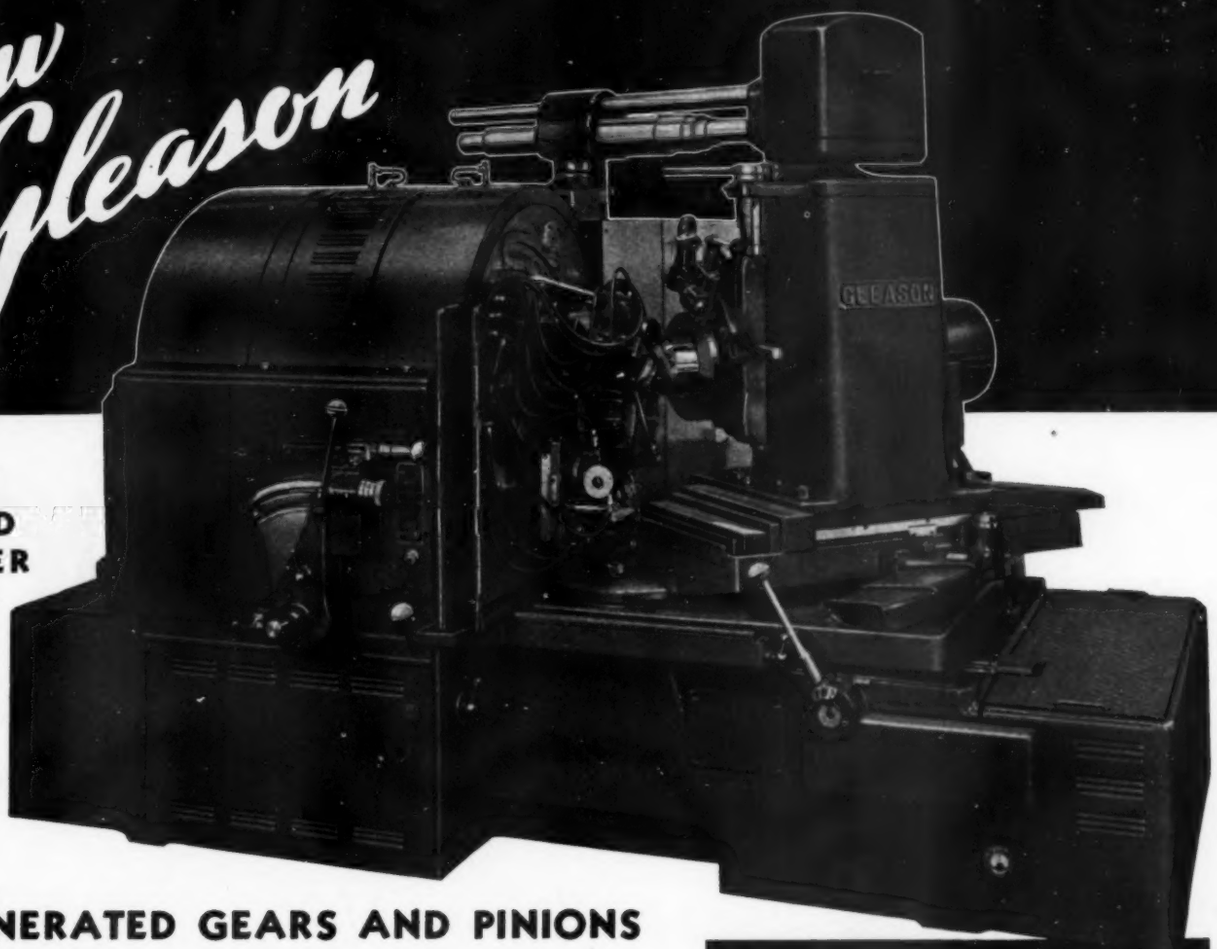

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Ratio, shafts at 90	1 to 1—4½ to 1
Wheel diameters	5¾" to 13½"
Feeds, time per pass per tooth	1.9 to 11.8 sec.
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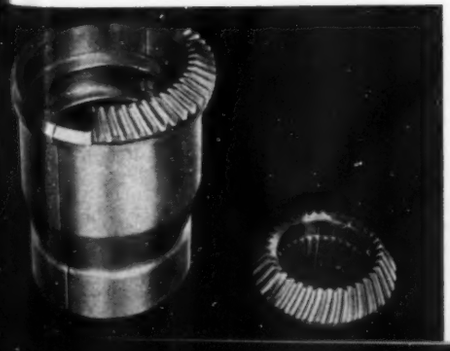

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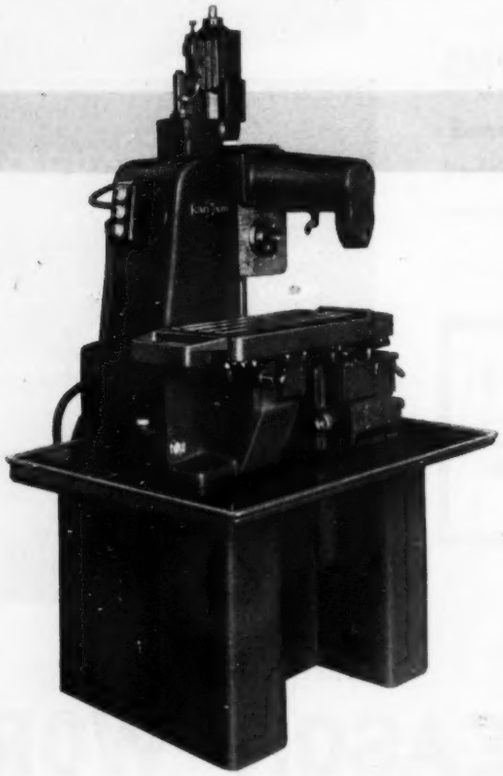

The No. 0-8 equipped with Rise and Fall Spindle Carrier as shown in the illustration at the left, is built to mill small parts fast and accurately. Parts for small arms, airplanes, range finders, photographic equipment, tanks, instruments, fuses and innumerable other items essential to the war effort are being milled on the No. 0-8.

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Investigate NOW! Specification catalog M-964 gives complete information on all features and their benefits. Send for your copy today.

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Cincinnati, Ohio U. S. A.

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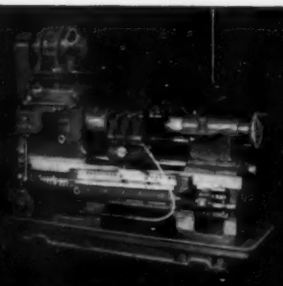
While the Good People

One Sunday morning in the Spring of 1793 (the time when the people were at "meeting" being chosen to avoid the jeers of a crowd in case of failure) Captain Morey launched his steamboat at his ferry landing at Orford and with one assistant to steer, while he himself managed the engine, they steamed up the Connecticut for several miles above Orford and safely returned, making about four miles an hour against a quite rapid current. This was fourteen years before the first trip of Fulton's "Clermont" upon the Hudson.



FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS

OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

ple were at "Meeting"

THE last steamboat that Captain Morey made with the original engine of 1793 now lies at the bottom of the Vermont lake that bears his name. Yet the same progressiveness shown in the life of early Vermont industrial pioneers still characterizes Jones & Lamson Machine Company today.

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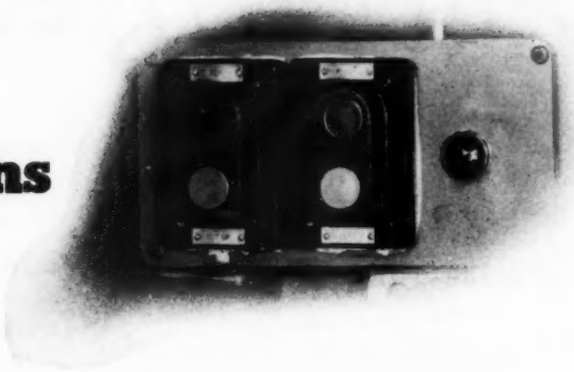

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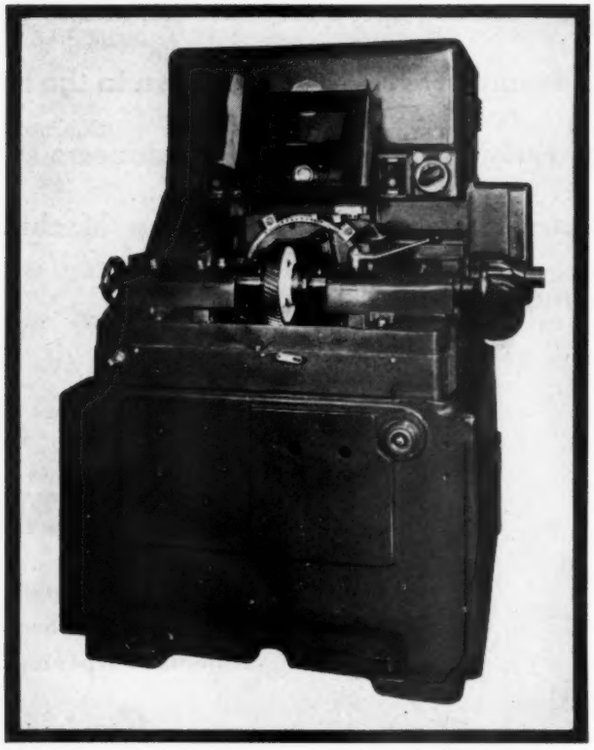

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MACHINES AND TOOLS FOR GEAR PRODUCTION

Pilot Lights

SPEED UP Gear Finishing . . .

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Method

. . . . FROM BLANK TO FINISHED GEAR

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It is

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"And there isn't a machine on the market to compare with it in its class."

"Running 'Dead True' thanks to Cincinnati engineers."

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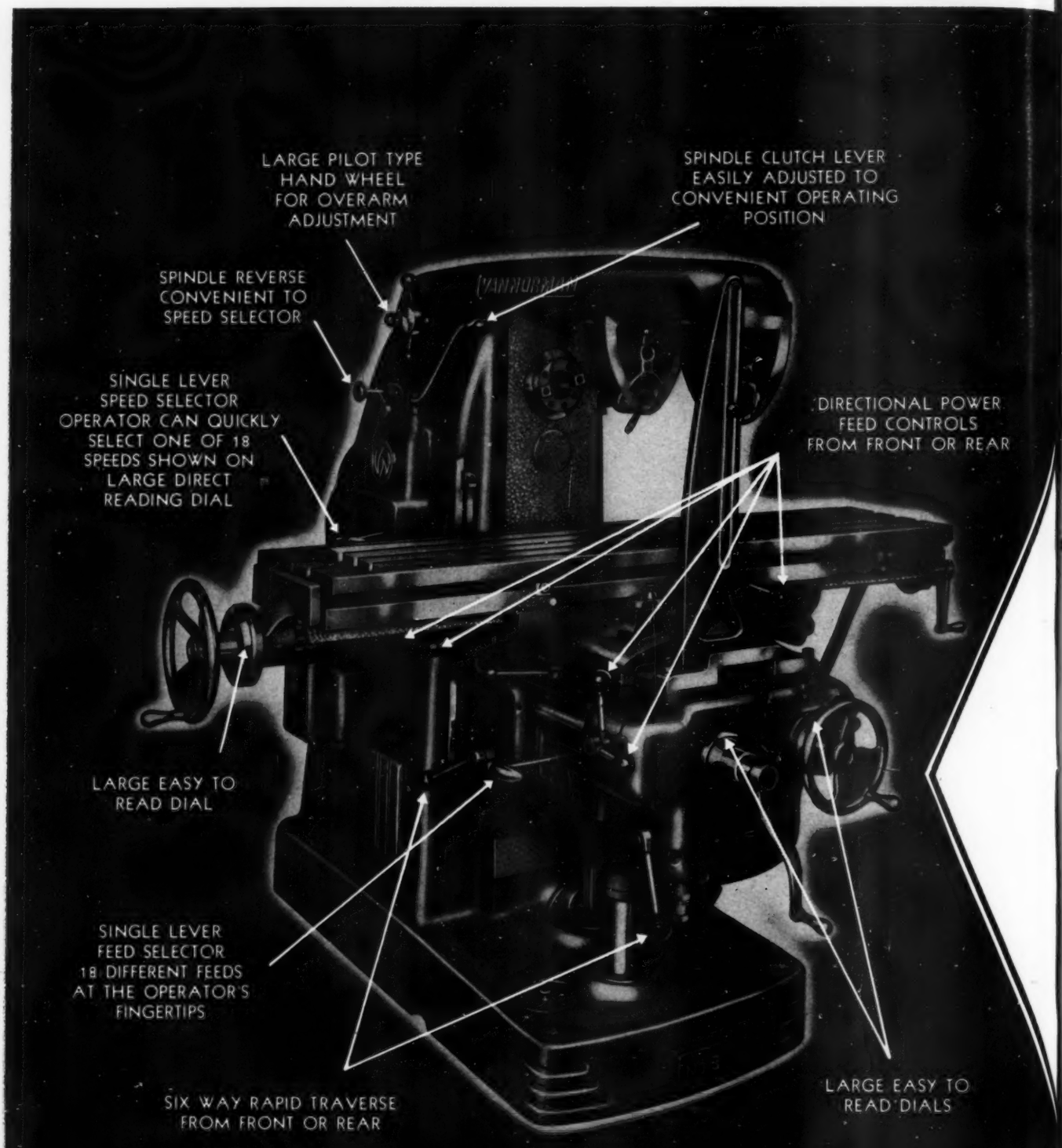
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LARGE EASY TO READ DIALS

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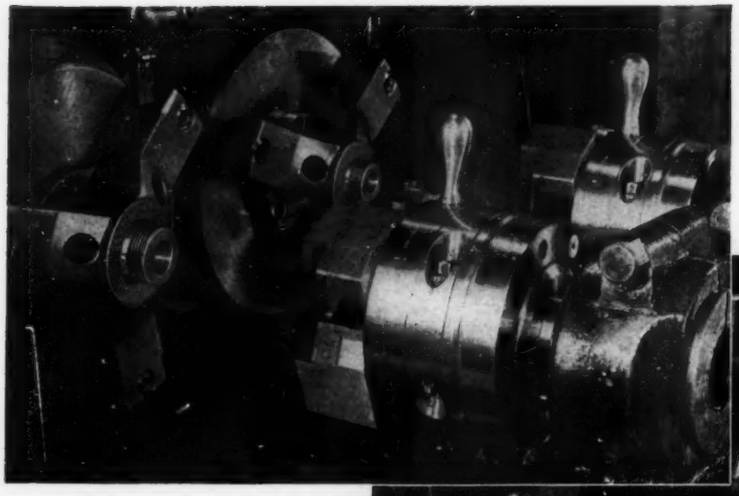
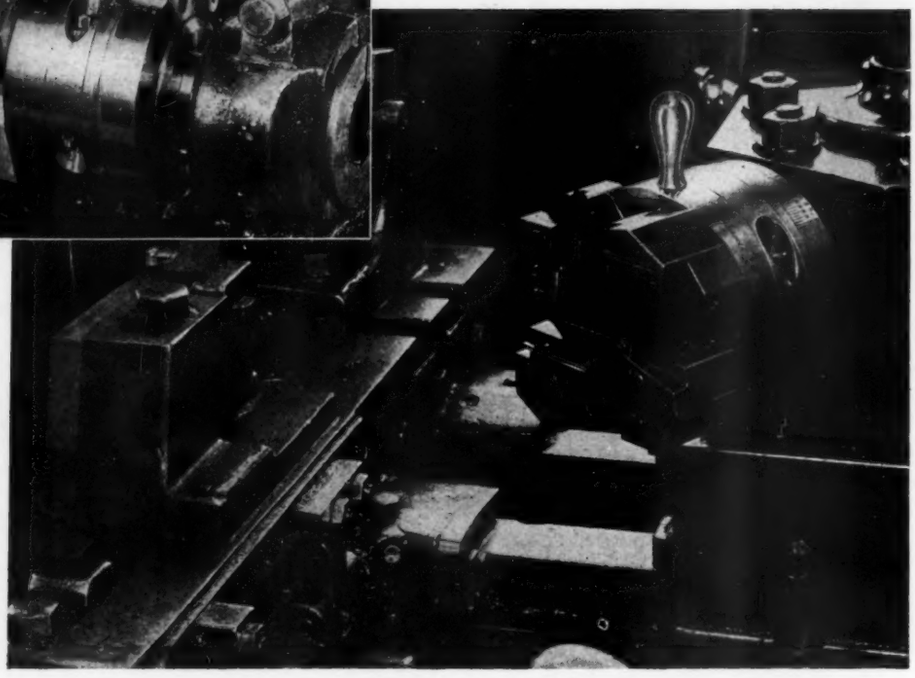
VAN NORMAN MACHINE TOOL CO.
SPRINGFIELD, MASS.

VAN NORMAN
Milling Machines



Step-Up National Production



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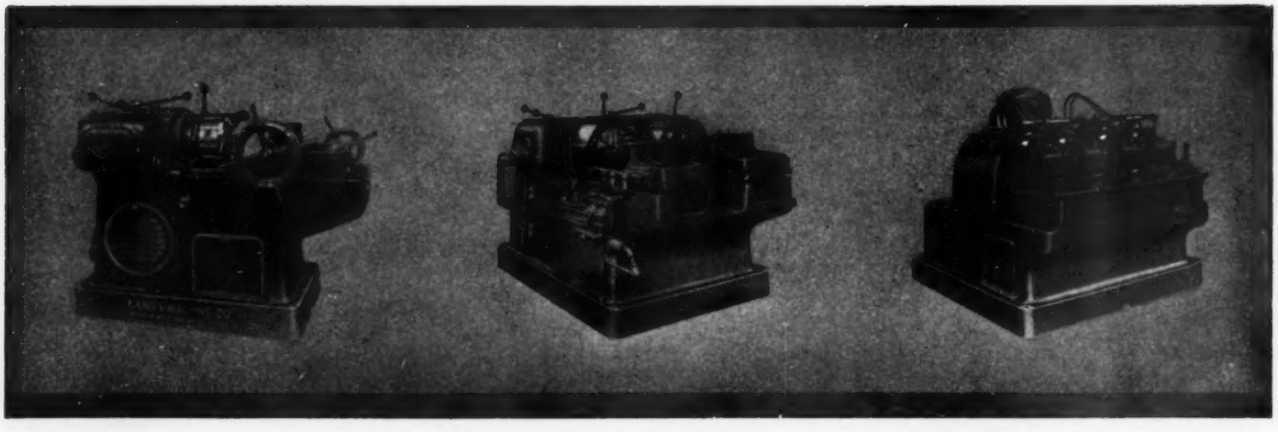

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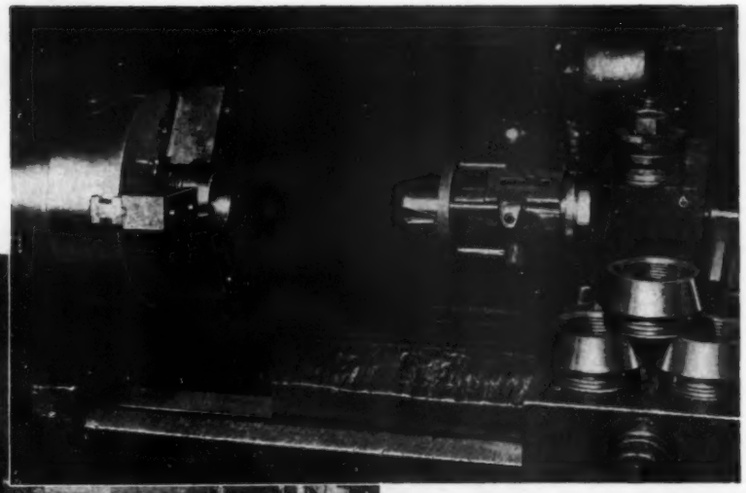

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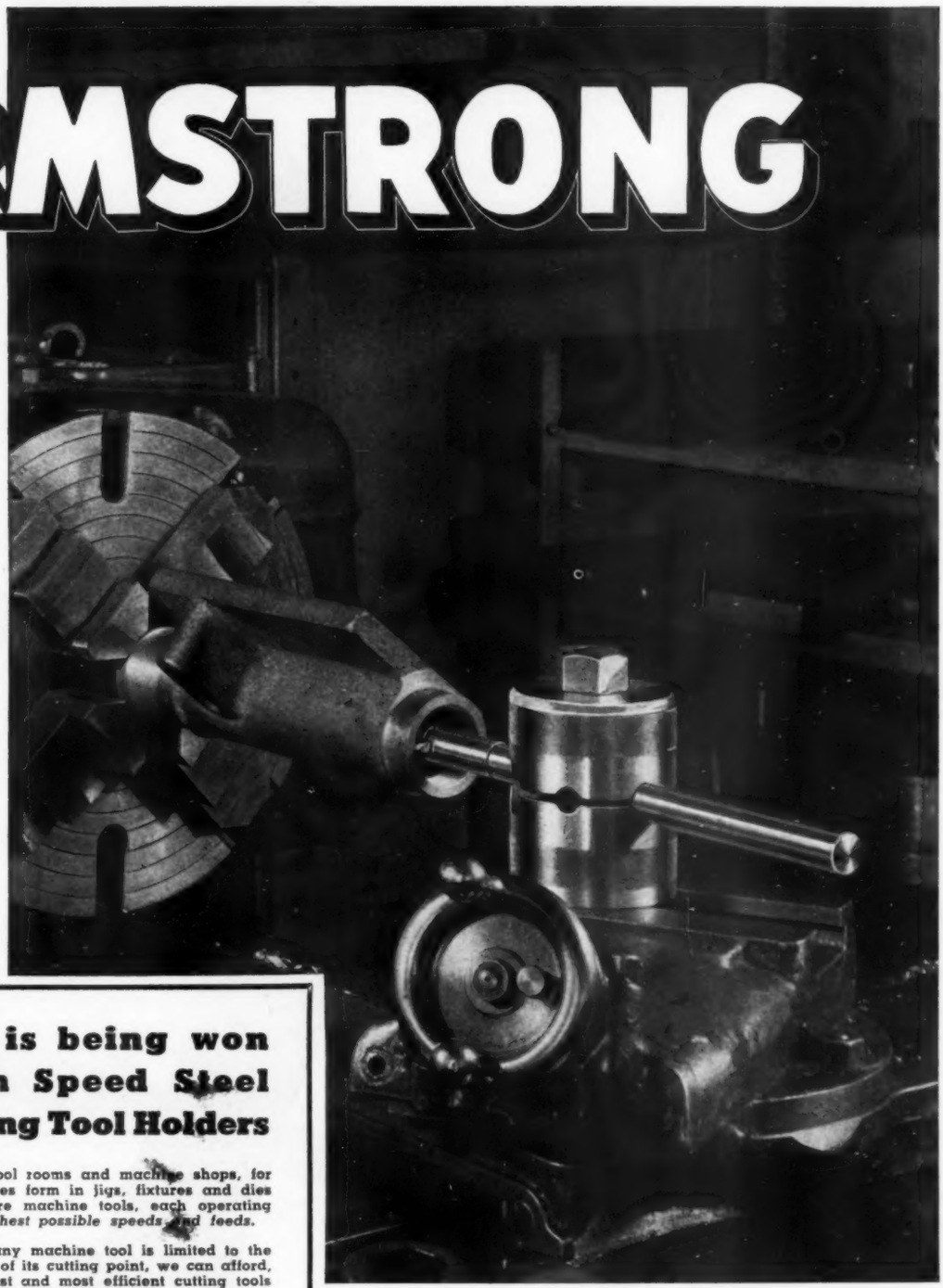

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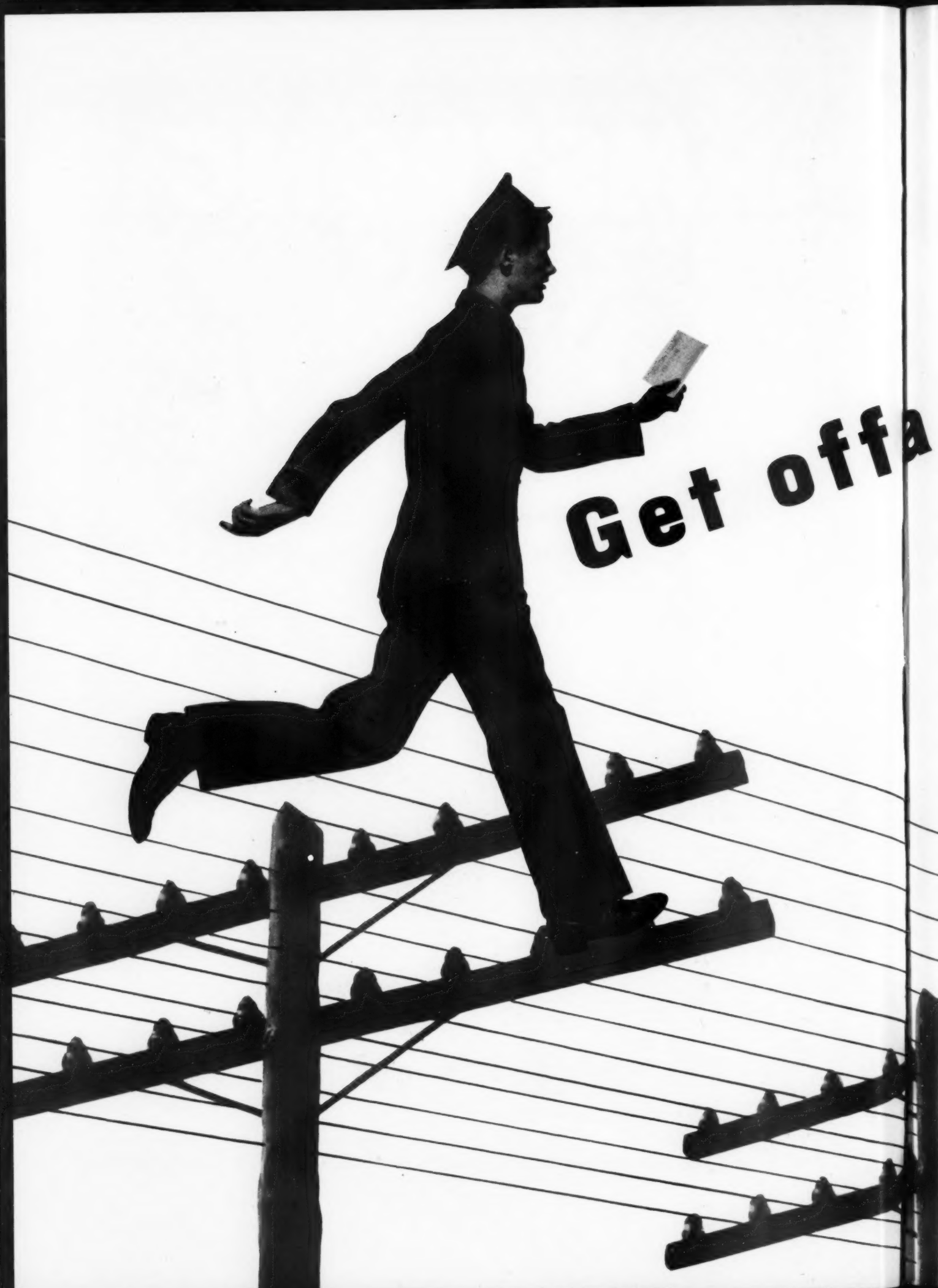
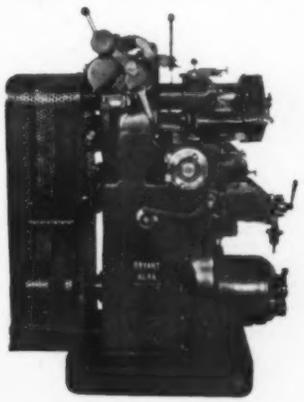
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms


Get offa

fa wire to Bryant

In many a new production plan, critical points develop on internal grinding operations. When this happens, give your engineering department a break. Get off a wire to Bryant. Supplement and reinforce the skill, experience and knowledge of your own staff with the specialized training of Bryant engineers.



In order to speed defense, Bryant production capacity has of course been stepped up. Already tripled, it is constantly increasing. But Bryant engineering has been stepped up also — stepped up not only to aid defense but to help you start now, at once, making shrewd, far-sighted plans for the low cost production of goods to sell at a profit.

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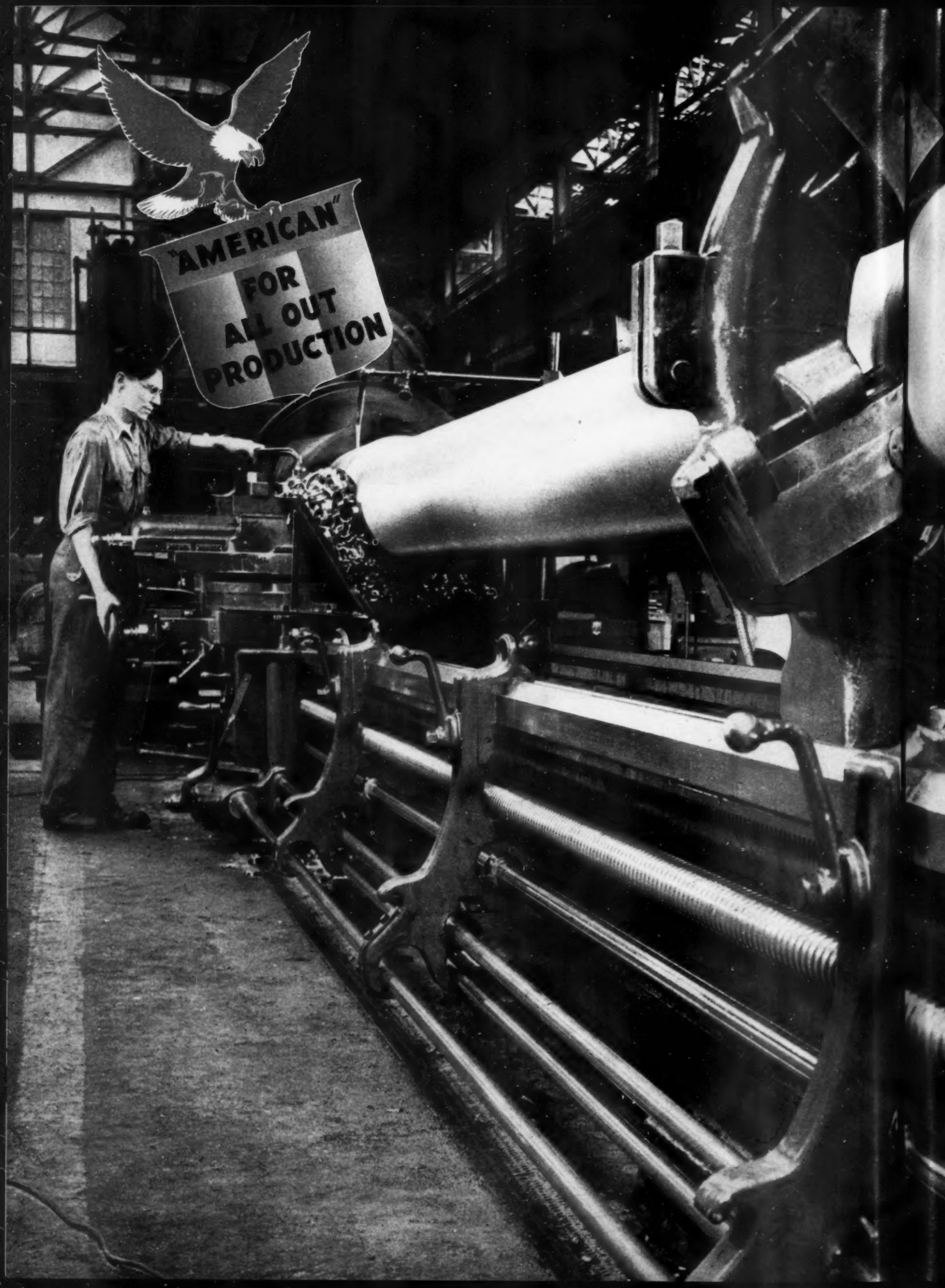
BRYANT [illegible]ING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.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PRODUCTION

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"AMERICAN" 48" Lathes, both in Navy Yards and Contractors' Plants, are adding their enormous power and productive capacity to the building of our "two-ocean" Navy.
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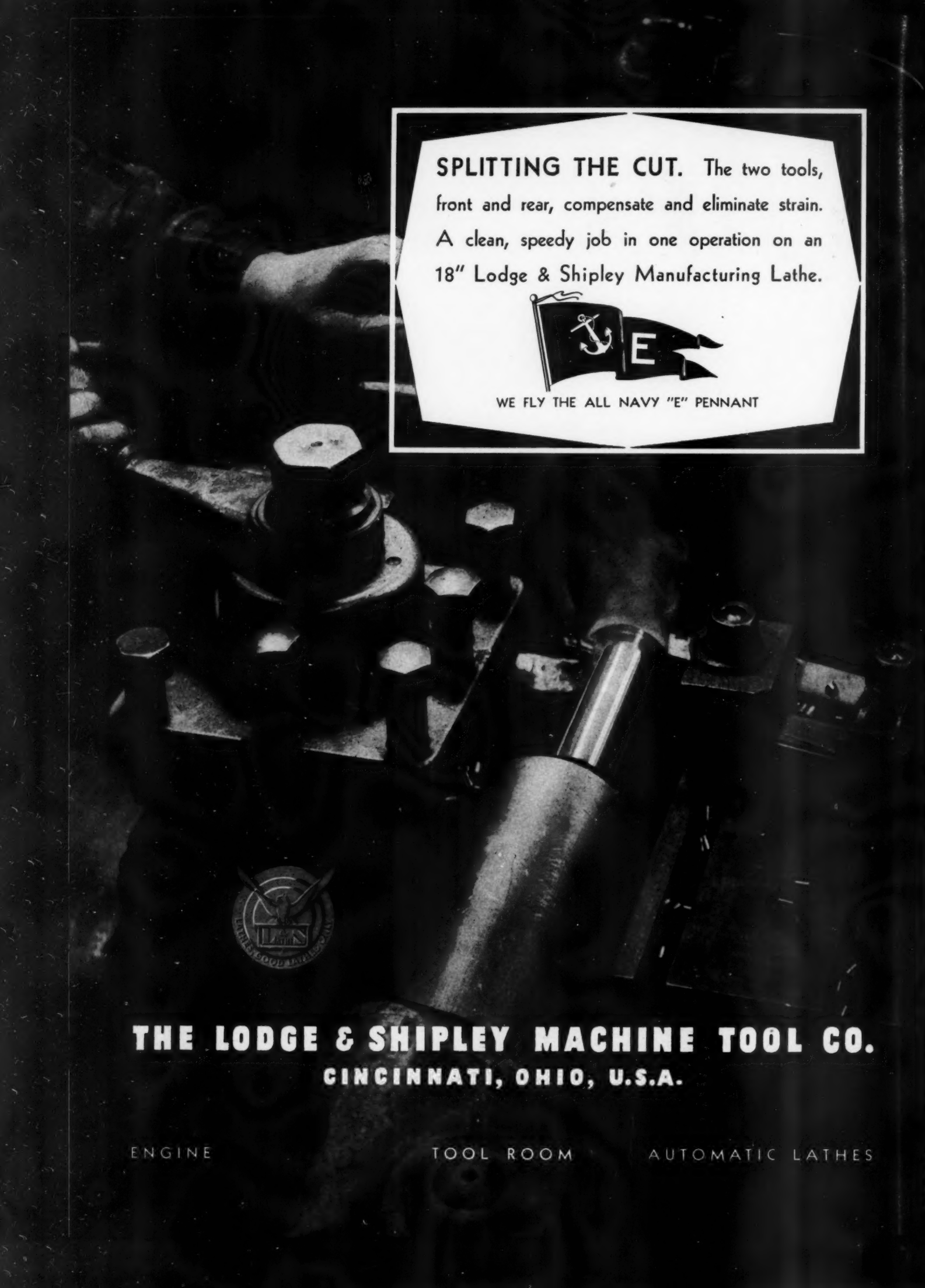
Lathes - Radials - Shapers
CINCINNATI, OHIO, U. S. A.


SPLITTING THE CUT. The two tools, front and rear, compensate and eliminate strain. A clean, speedy job in one operation on an 18" Lodge & Shipley Manufacturing Lathe.
E
WE FLY THE ALL NAVY "E" PENNANT
THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.
ENGINE
TOOL ROOM
AUTOMATIC LATHES

NOSING THEM OUT FOR VICTORY

This Clearing mechanical 400 ton capacity welded steel press is now performing the nosing operation on 105 m.m. shells at an extremely rapid rate. Requiring exacting workmanship; this job is ably handled by Clearing presses. Begin "Clearing the Way" with a line of Clearing presses.

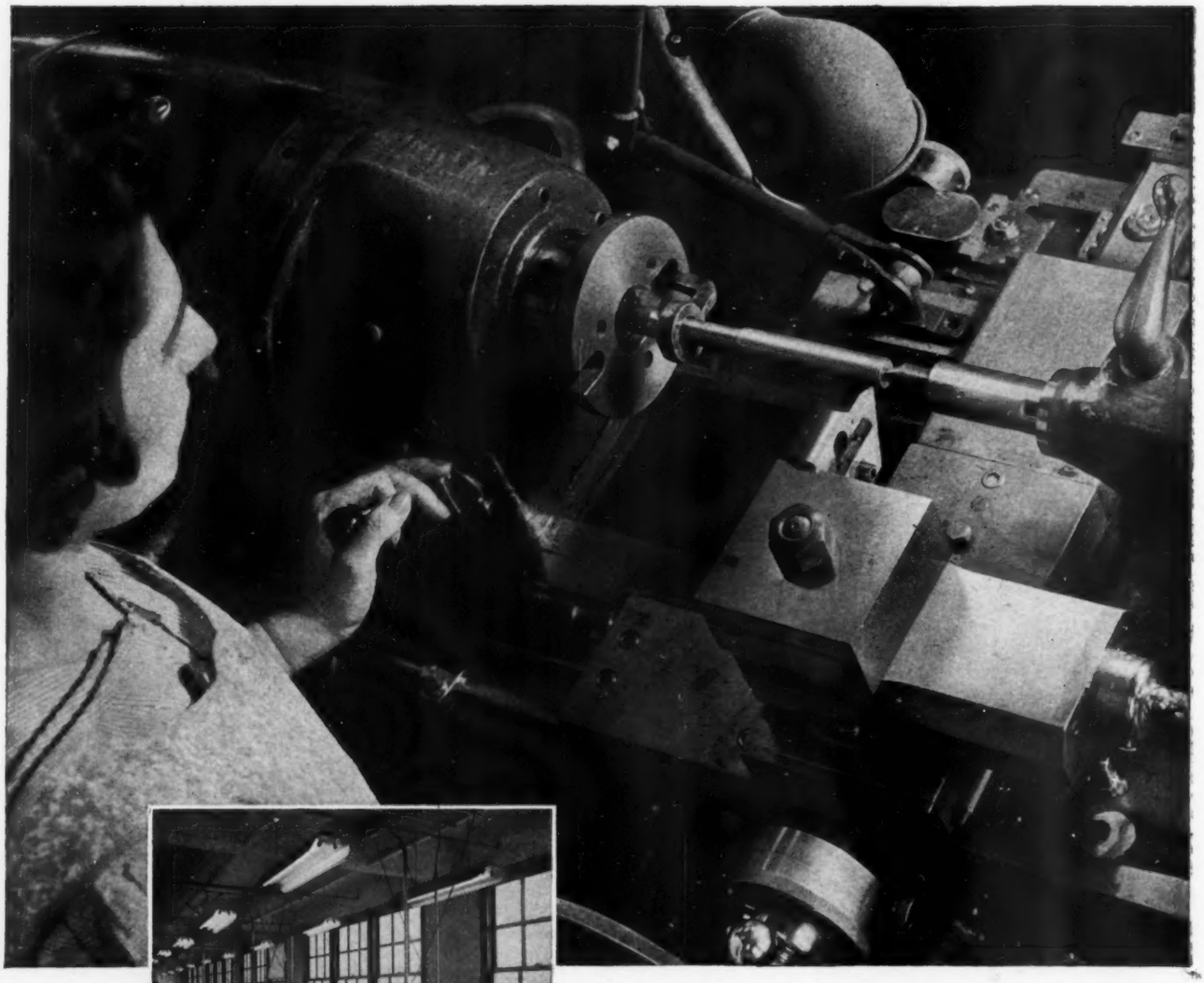
Clearing mechanical and hydraulic presses. All sizes and capacities.

CLEARING MACHINE CORPORATION
6499 WEST 65th STREET CHICAGO, ILLINOIS

MECHANICAL AND HYDRAULIC PRESSES

CLEARING
MACHINE CORPORATION
CHICAGO

New Operators
TRAINED QUICKLY



THE MONARCH MACHINE TOOL

COMPANY • • • SIDNEY • OHIO

FOR HIGH PRECISION WORK

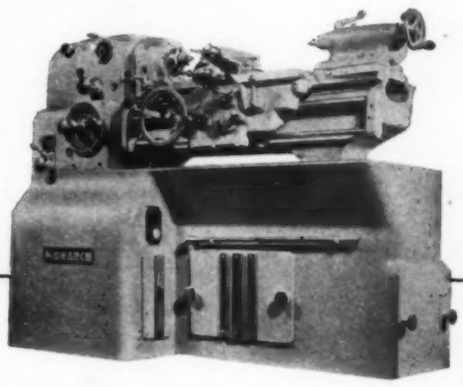
Chasing thread gage laps is one of the most accurate operations in gage work, yet within a few weeks after installing their first machine in this department, The Taft-Peirce Manufacturing Company of Woonsocket, R. I., is operating its entire battery of 16 Monarch Sensitive Precision Lathes with previously untrained help. In spite of this seemingly short training period, production rate is high, accuracy well within required tolerances, and the number of rejects surprisingly low.

To maintain production, the first Monarchs delivered were manned by experienced workers. One by one, new operators were carefully trained, and now have released these skilled men for other work.

This is one of many examples which prove the utility of Monarch Lathes. Simple and easy operation allows immediate production of many repetitive jobs by previously unskilled operators. Accuracy is so much a basic part of Monarch Lathe design that neither quality of work nor production rate suffers by such emergency measures.

Further—this is additional proof that even under present production pressure, there is no letdown in Monarch quality.

For thread chasing and heavier turning, Monarch Sensitive Precision Tool Makers' Lathes include a (6 to 1) back-geared unit as an integral part of the drive motor, operated from front of the lathe. This lathe permits bench precision accuracy and is designed for easy and convenient handling of work with less operator fatigue.



MONARCH LATHES

COVER THE TURNING FIELD

"PUT IT ON THE BLANCHARD"

BLANCHARD

FLAT WITHIN .000007"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
★ Adaptability
Fixture Saving
Operation Saving
Material Saving
★ Fine Finish
★ Flatness
★ Close Limits

★ . . . . Especially valuable on jobs like the one illustrated.

Here are semi-cast steel compressor heads being ground on a No. 11 Blanchard Surface Grinder to the almost *unbelievable flatness of* .000007"—(that's seven millionths of an inch). The finish measures 6 micro inches. Yet this is a regular production job in a leading electrical products manufacturing plant. The heads are 7" in diameter and 3¾" thick. .005" of stock is ground off one surface. Production averages 40 parts per hour.

Fast, accurate and easy to operate, this smallest Blanchard Grinder has proved to be profitable for either tool work or small lot production.

Grinding compressor heads on the No. 11 Blanchard Grinder

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

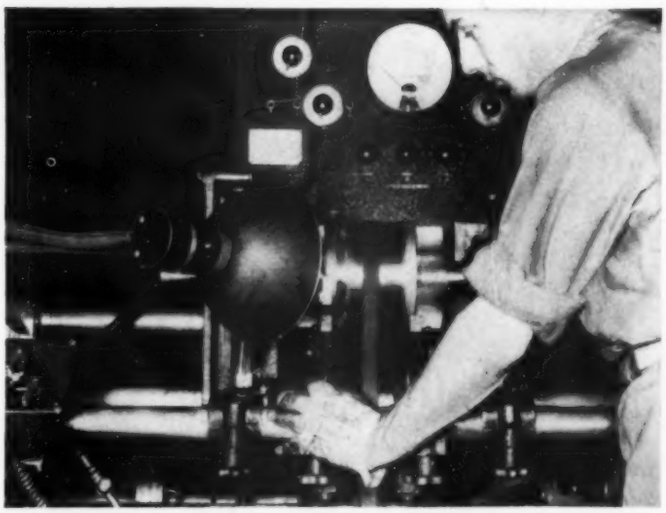
Unbalanced! ... ME?

FORGIVE US, Rover, for making an example of you! But your joyous moments, when the tail wags the dog, remind us of the way that one unbalanced part can shake—and punish—a whole motor assembly.

Take, for example, a 40-lb. electric motor. At only 200 r.p.m., one ounce inch of unbalance in the armature may not seem so important. But now step the speed up to 5000 r.p.m. and that unbalanced force becomes *44.3 lbs.*—more than the weight of the motor itself. It's enough to shake the motor off its base 5000 times a minute. And there's nothing so joyous about that!

These destructive, unbalanced forces which overload bearings, cause vibration, excessive wear, and noise, are now easily found and corrected through the use of Gisholt Dynetric Balancing Machines. The operation is simple and takes only a matter of seconds. These machines are so accurate they can measure unbalance vibrations down to .000025".

Write for literature.



● *Using the radio means of amplification, this sensitive machine picks up static and dynamic unbalance vibrations and magnifies them as much as 1,600,000 times. It makes proper balance easier, quicker, and more economical to attain than ever before.*

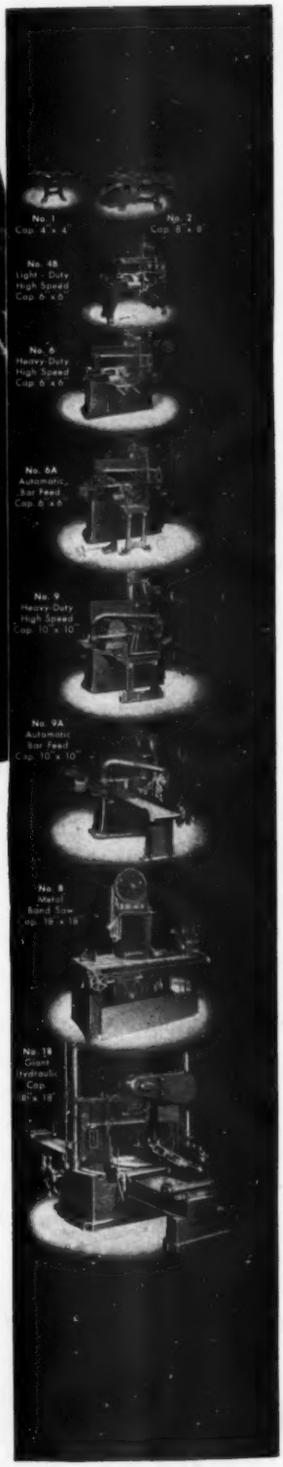
DYNETRIC BALANCING MACHINES

GISHOLT

GISHOLT MACHINE COMPANY, 1201 Washington Avenue • Madison, Wisconsin

LOOK AHEAD ... KEEP AHEAD ... WITH GISHOLT IMPROVEMENTS

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES



MARVEL SAWS

Fully Universal

At least one MARVEL No. 8 Metal-cutting Band Saw is found in all well tooled plants to handle miscellaneous work, much of it impossible for other sawing machines. The largest capacity metal band saw built, yet equally efficient on the smallest and most delicate work, it is one of the busiest tools in the shop. Cuts-off bar steel, pipe, tubing, mouldings, structural steel; cuts-off and miters with maximum speeds and feeds—will do everything that any other metal saw will do, more conveniently, more accurately; and in addition, a vast variety of work no other metal saw will handle, such as cutting at any angle up to 45° degrees right or left without moving the work.

ARMSTRONG-BLUM MANUFACTURING COMPANY

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York

SPEED PRODUCTION WITH BETTER TOOLS AND SAVE VITAL ALLOYS

THESE BULLETINS TELL HOW

Mail this Coupon Toda

FIRTH-STERLING STEEL C

McKEESPORT, PA.

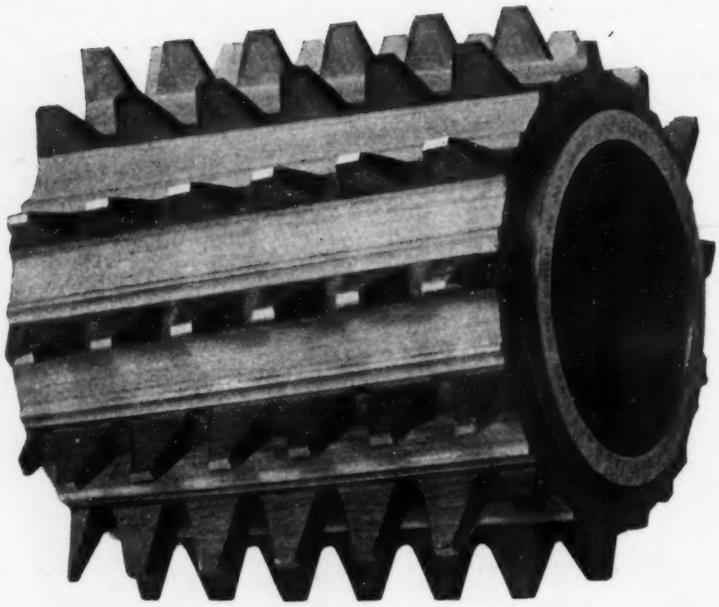
Gentlemen: Please send me without obligatio the FREE BULLETINS I have checked below (Bulletins contain sizes and prices.) AM 4

- ☐ **FIRTHITE Tools, General Purpose**
- ☐ **FIRTHITE Tips, Standard**
- ☐ **FIRTHITE Tools, Standard and Special for Special Purpos**

NAME _____

COMPANY _____ POSITION _____

ADDRESS _____



THIS HOB produced 66,937 lineal inches of gear tooth in the six months preceding its "retirement". The teeth were ground back until they were only 5/64" thick at the tip, yet not a single tooth broke out. Made double-thread, ground form, this hob was used to cut 35 tooth, 5-7 pitch gears, 7-1/4 diameter by 1-1/4 face. Material was SAE 4620 annealed steel. Average production, using .060 feed per revolution of work and hob speed 154 r.p.m., was 10.6 gears per hour. Total life was 29 sharpenings, with .019" stock removed per grind. 3 settings per grind, 18 pieces per setting were obtained.

PROPER HOB SHARPENING GIVES LONG LIFE AND MAXIMUM PRODUCTION

"Conserve critical materials!" This is an important watchword in these times of war. Users of hobs are vitally affected as it becomes necessary to get the greatest possible production from cutting tools of all kinds. The following precautions will be helpful in this effort, to assist you in getting the maximum life out of your hobs.

OBSERVE THESE SUGGESTIONS...

1. Use index method of sharpening. Maintain proper spacing of flutes.

2. Be sure that hob teeth are sharpened radially. Avoid a positive or negative rake, except in cases where it is recommended, such as B-C *Hi*-Production Hobs.

3. Guard against hob runout on either or both ends on the sharpening machine.

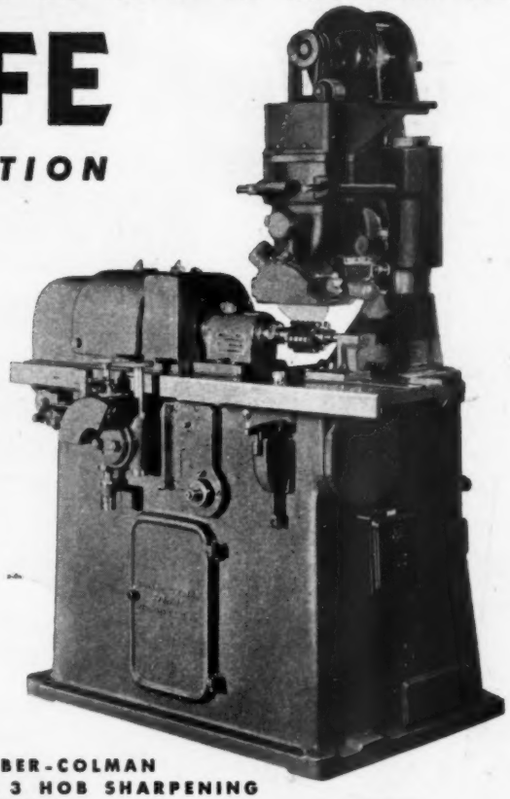
4. Do not allow hobs to become excessively dull in one position. Sharpen at regularly determined intervals, whether the hob "looks like it needs it or not."

5. Always remove a uniform amount of stock.

6. Be sure to select the proper grade of grinding wheel.

7. Shift hob position frequently.

8. Correlate feed and speed to be used, with the production desired, so that resulting hob cost will not offset the advantages of the increase in production.



BARBER-COLMAN NO. 3 HOB SHARPENING MACHINE

Specially designed for sharpening hobs and formed cutters, this machine insures duplication of original sharpening. Once the set-up is completed, the entire sharpening operation is automatic, relieving the operator for other work. Write for descriptive bulletin F654-5.

BARBER B-C COLMAN PRODUCTS: HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

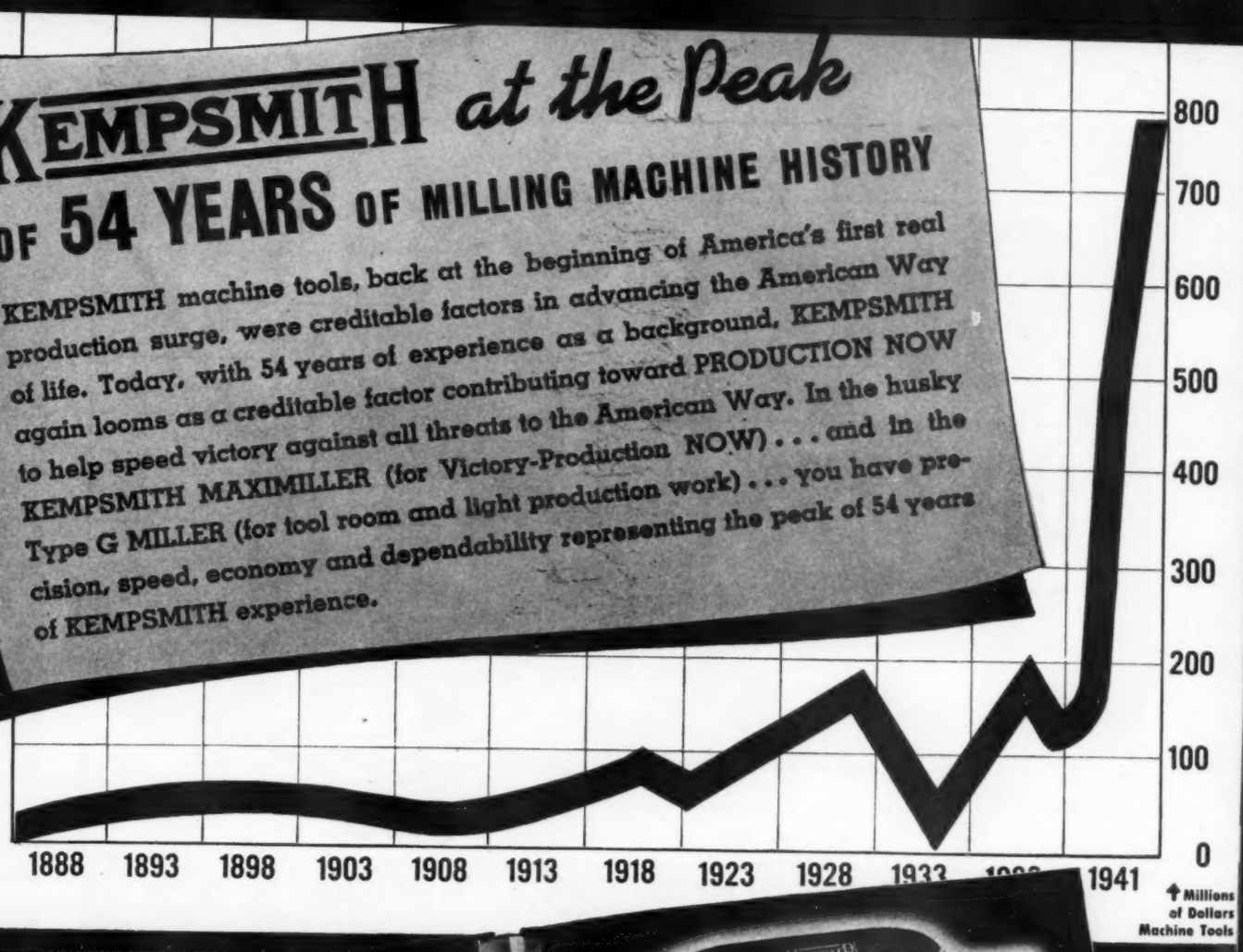
BARBER-COLMAN COMPANY

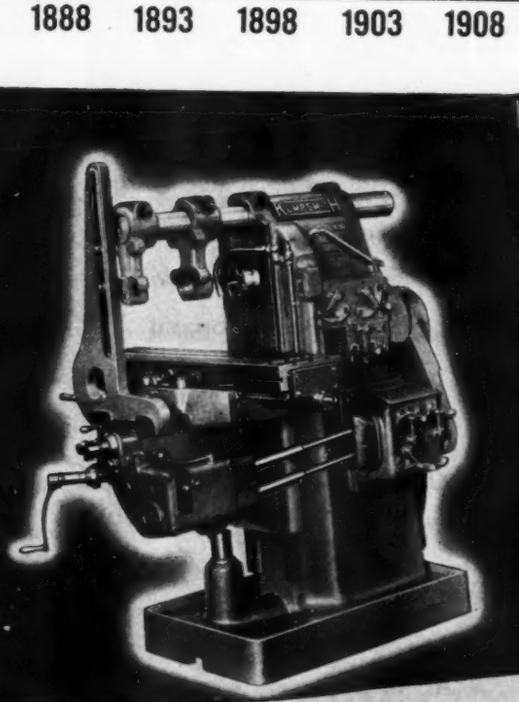
General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

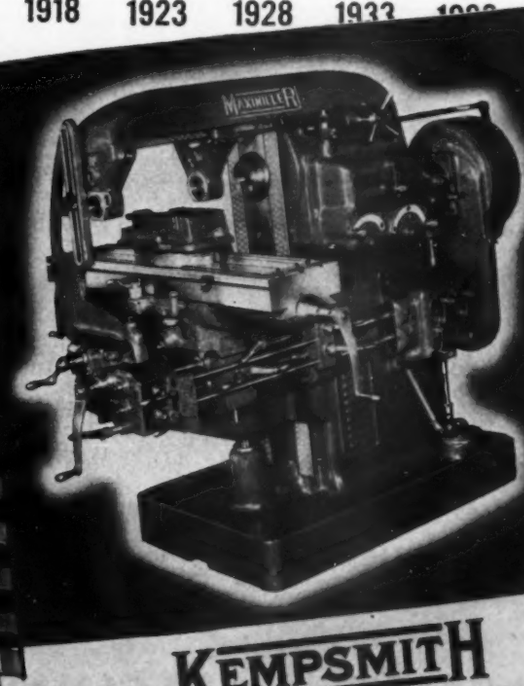
KEMPSMITH *at the Peak*

OF 54 YEARS OF MILLING MACHINE HISTORY

KEMPSMITH machine tools, back at the beginning of America's first real production surge, were creditable factors in advancing the American Way of life. Today, with 54 years of experience as a background, KEMPSMITH again looms as a creditable factor contributing toward PRODUCTION NOW to help speed victory against all threats to the American Way. In the husky KEMPSMITH MAXIMILLER (for Victory-Production NOW) . . . and in the Type G MILLER (for tool room and light production work) . . . you have precision, speed, economy and dependability representing the peak of 54 years of KEMPSMITH experience.







KEMPSMITH TYPE "G" MILLER

. . . "brother" of the famous KEMPSMITH MAXIMILLER

KEMPSMITH MAXIMILLER

. . . built to speed up production on "3-shift" schedules

PRECISION

MILLING MACHINERY

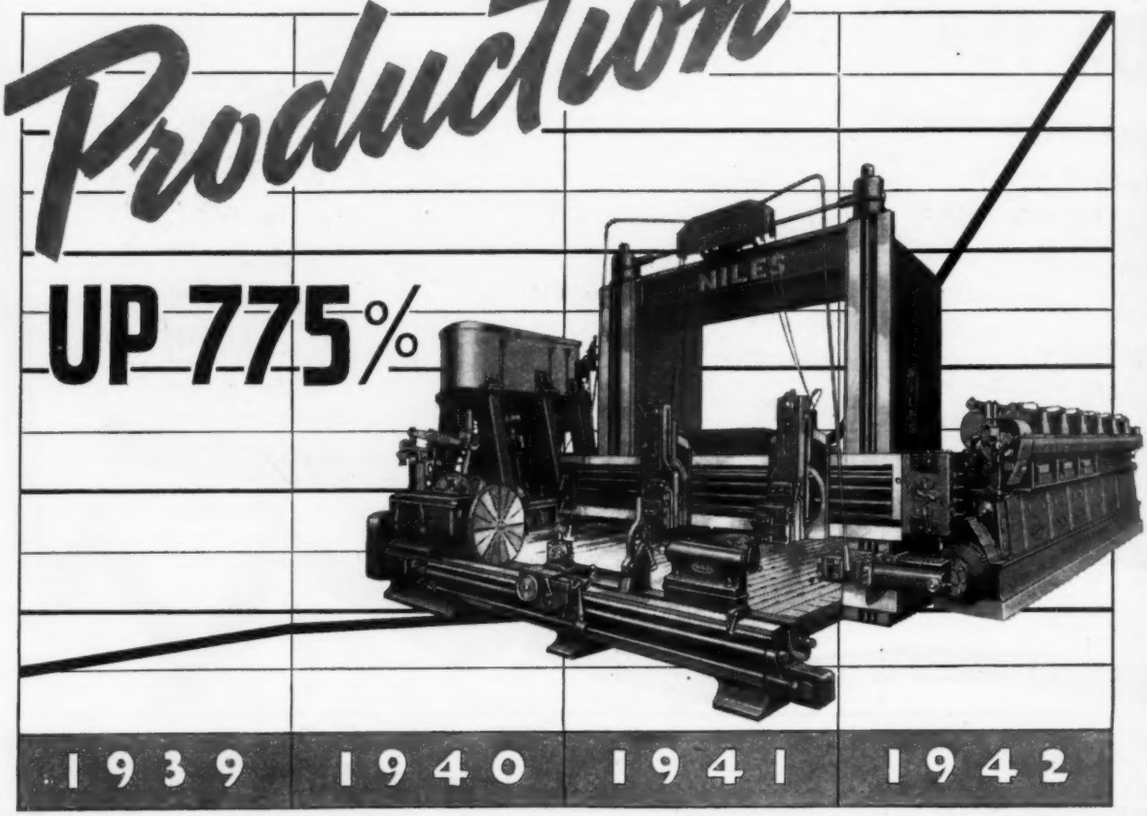
Experience SINCE 1888

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN

Production

UP 775%



1939 | 1940 | 1941 | 1942

OUR production for 1940 was entirely for war. So it was in forty-one on a much larger scale. The same will be true this year in quantities again greatly enlarged. New manufacturing facilities now under construction will vastly amplify next-year's production over 1942.

We are proud of this record not alone because of its spectacular proportions. We are proud of it because it typifies that intangible something familiarly known among those who possess it as the "Know How". Call it what you will, it is a Yankee characteristic as American as the Stars and Stripes. It pervades American industry on the march as completely as does the patriotism that puts it to work. It is the foundation on which our industrial supremacy is built, the bulwark which shall forever protect the spiritual values it has created.

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

GENERAL MACHINERY ORDNANCE CORPORATION
THE NILES TOOL WORKS CO. · THE HOOVEN, OWENS, RENTSCHLER CO.

You can cut installation time almost 50%

WITH G-E COMBINATION STARTERS

Regularly furnished for use with motors up to 200 hp

MOUNTING TIME CUT 50%

You avoid one complete mounting job on every installation when you use combinations—because combination starters combine both a motor switch and a magnetic starter in one compact unit.

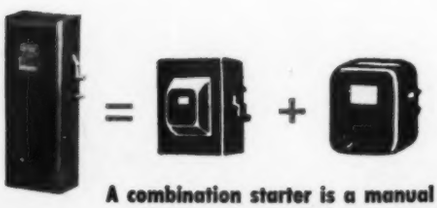
WIRING TIME CUT 40%

Users report that they're cutting wiring time as much as 40 per cent with G-E combination starters. That's because these combinations come to you already wired. Just connect the power and motor leads and you're ready to go.

COMPLETE PROTECTION FOR EQUIPMENT AND PERSONNEL

Fuses and overload relays are co-ordinated to provide complete protection for your operating equipment. A special safety interlock—case cover can't be opened while power is ON, and power can't be thrown ON while cover is open—provides extra protection for your operators and maintenance men.

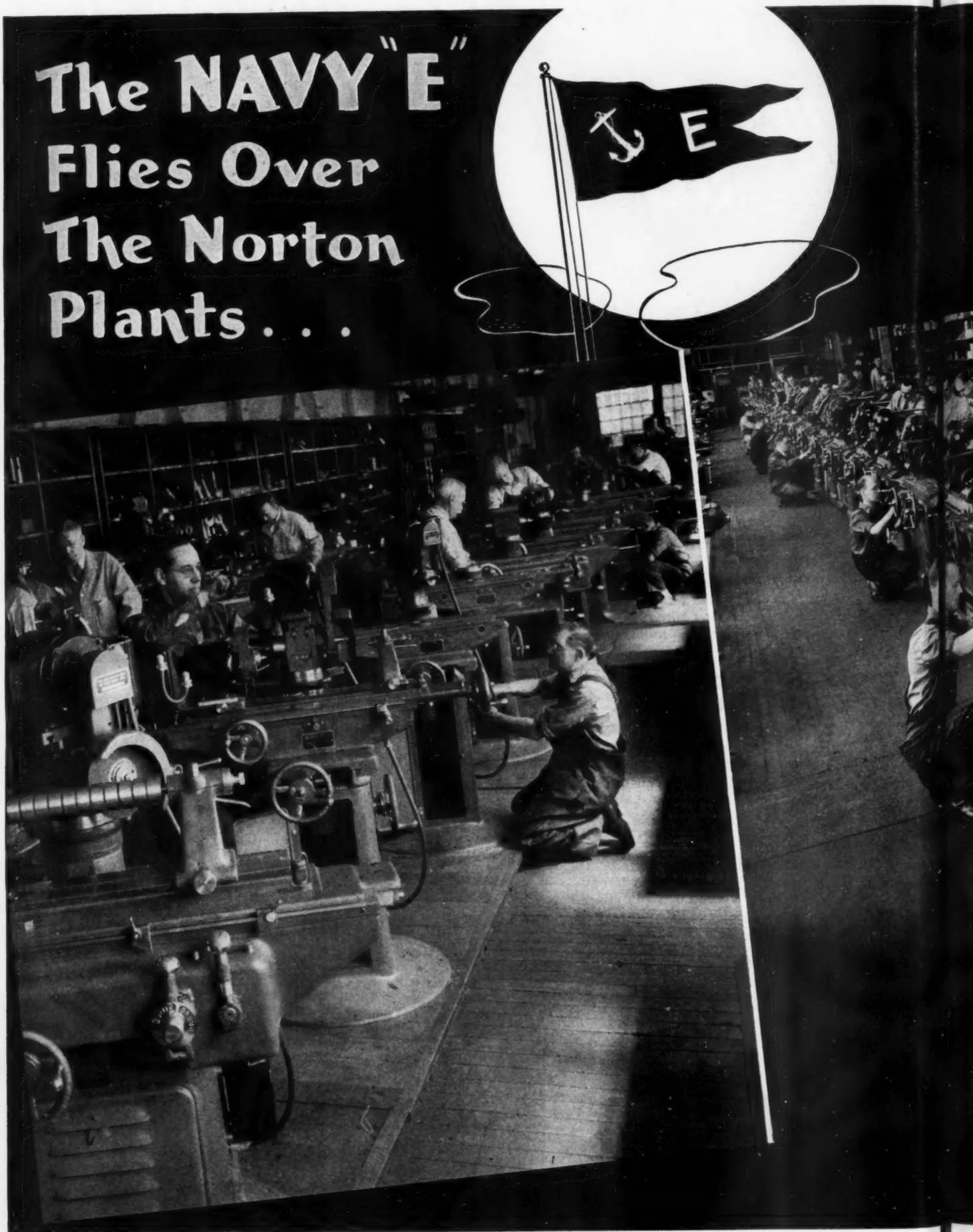
But these aren't the *only* advantages of G-E combinations. Their compact construction saves you valuable plant space. This same compactness can help you speed production—you mount the whole control close to the operator's work. Call our local office today to find out what G-E combination starters can do on your job. *General Electric, Schenectady, N. Y.*



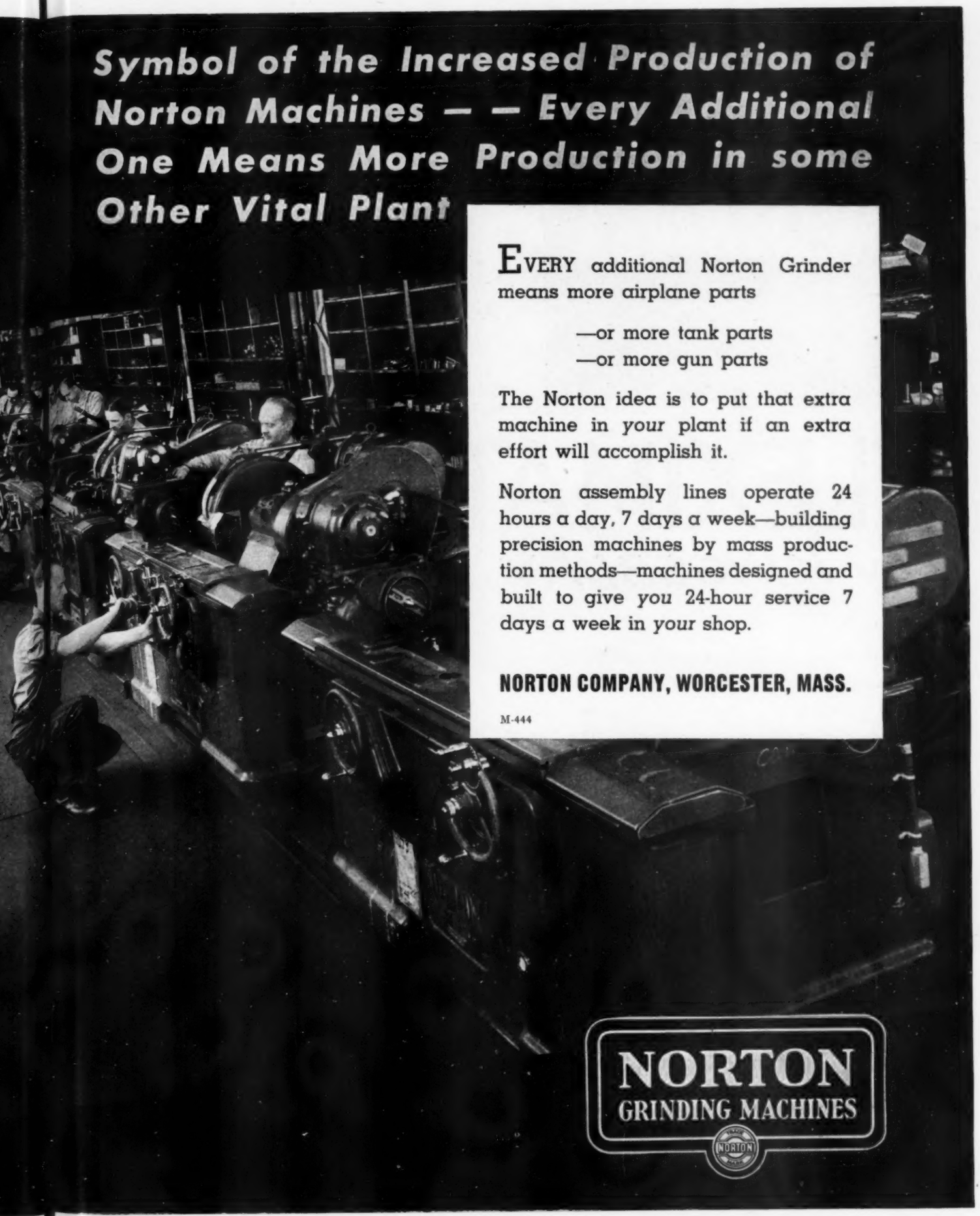
A combination starter is a manual circuit switch plus a magnetic starter.

676-65-8490

GENERAL ELECTRIC


The NAVY "E"
Flies Over
The Norton
Plants . . .
E

Symbol of the Increased Production of Norton Machines — — Every Additional One Means More Production in some Other Vital Plant



EVERY additional Norton Grinder means more airplane parts

—or more tank parts
—or more gun parts

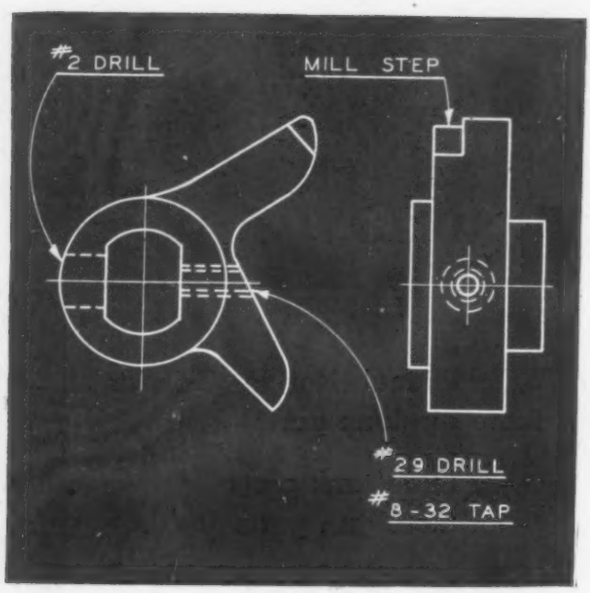
The Norton idea is to put that extra machine in *your* plant if an extra effort will accomplish it.

Norton assembly lines operate 24 hours a day, 7 days a week—building precision machines by mass production methods—machines designed and built to give *you* 24-hour service 7 days a week in *your* shop.

NORTON COMPANY, WORCESTER, MASS.

M-444

NORTON
GRINDING MACHINES



THIS IS A FLEXIMATIC AUTOMOTIVE JOB!

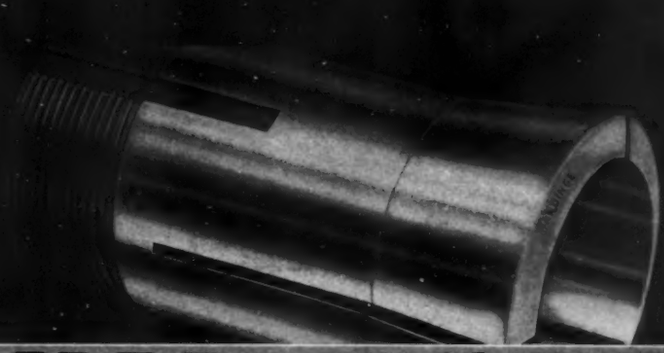
FLEXIMATIC

by KINGSBURY . . . . Flexible, Automatic, and Fast . . . !

Even such a small part as an automobile door latch presents an opportunity for savings when a Kingsbury FLEXIMATIC is used to produce them. The machine illustrated performs four operations—drilling two holes, tapping and milling—finishing these brass forgings at unbelievably high speeds. And, adding to the ease and economy of FLEXIMATIC operation is the fact that this machine doesn't even have to be unloaded! The operator merely loads the work and clamps it. It is automatically unclamped and ejected.

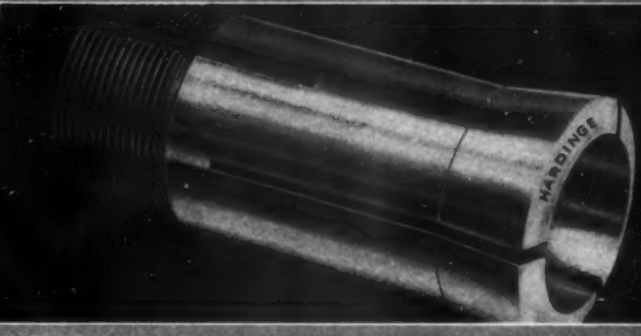
Kingsbury FLEXIMATICS are made up of standard units for drilling, milling, tapping, etc.—as many as necessary—mounted in any position on one of several types of standard bases. This Kingsbury method of standardizing the various units of assembly results in a machine that can easily be changed to meet changes in design and production . . . a FLEXIBLE, an AUTOMATIC, a FAST production machine.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U.S.A.

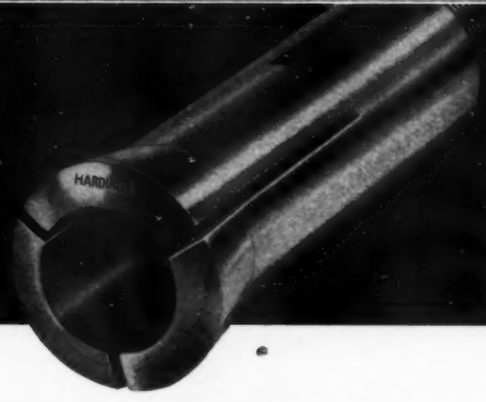


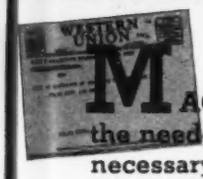
SPECIFY HARDINGE COLLETS...

FINISHED SIZES CARRIED IN STOCK



IN NINE KEY CITIES IN THE U. S. A.





MACHINE tools are important but, without the needed collet, they are useless. Avoid unnecessary delays and avail yourself of a good service by specifying **HARDINGE** Collets. Do this when ordering collets only, or when ordering Collets with Lathes and Milling Machines of any make or size. **HARDINGE** Precision Collets cost no more than other Collets.

HARDINGE collet stocks are carried in these cities for service to our customers: Elmira, Hartford, New York, Rochester, Cleveland, Detroit, Chicago, Los Angeles and San Francisco.

ASK FOR THE LATEST HARDINGE COLLET BULLETIN NO. 41.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

KEEP THEM ROLLING ALONG

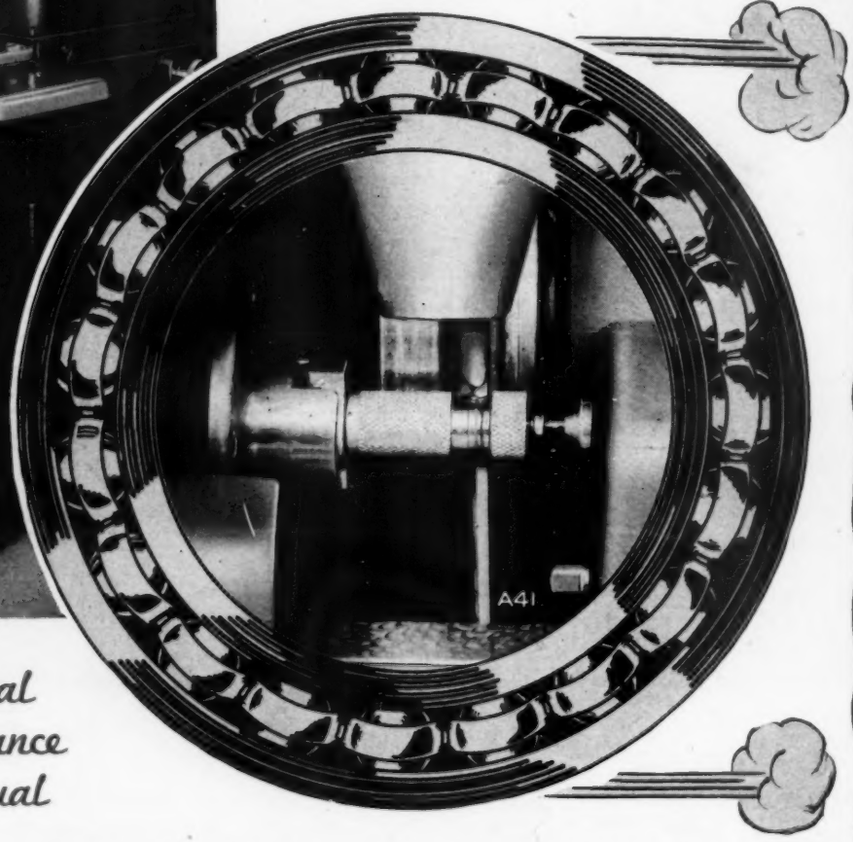
Below left:—4" Type H Plain at plant of ball bearing manufacturer.

Below right:—4" Type H machine set up to grind outer raceways of inner ball bearing races.

A well-known ball bearing manufacturer is keeping his production rolling along by using a Landis 4" Type H Plain Grinder for the form grinding of the outer raceways of inner ball bearing races. The machine grinds 130 races per hour within limits of .0002" concentricity and .0005" diameter. Stock removal is .005".

Production like this is certainly not limited to ball races. In various plants throughout the nation Landis 4" Type H Plain Grinders are grinding such parts as micrometer barrels, chuck jaws, gun parts, odd sewing machine parts, camera parts, valve stems, pipe taps, airplane engine parts and many other parts within close precision limits at a high rate of production.

Why not keep your production rolling along with a Landis Type H Plain Grinder. 384



PRECISION LANDIS GRINDERS

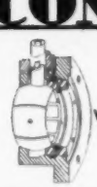
Unusual Performance As Usual

LANDIS TOOL COMPANY

WAYNESBORO PENNSYLVANIA

CYCLE CONTROL LEVER

VARIABLE VOLTAGE HEADSTOCK

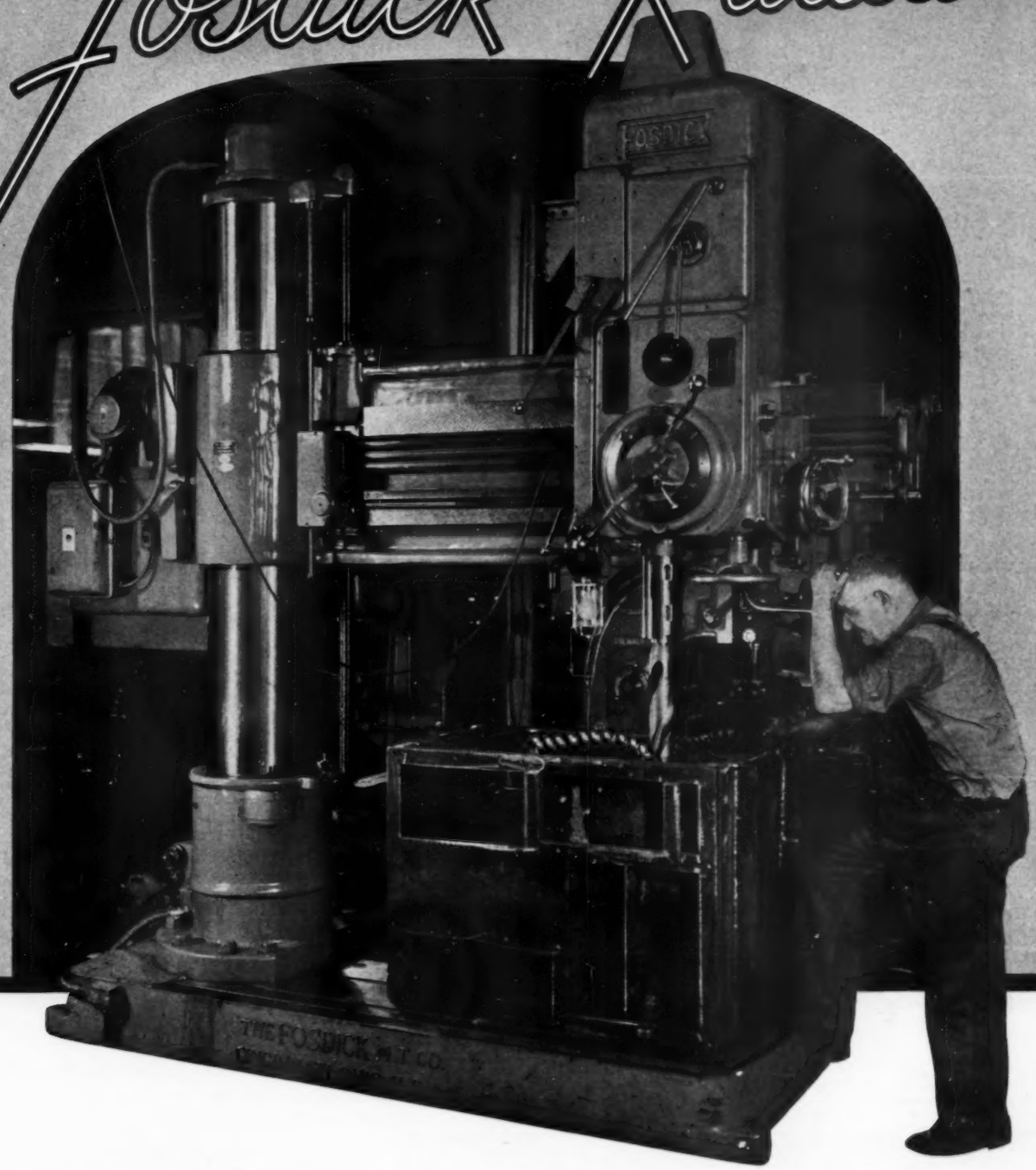


MICROSPHERE WHEEL SPINDLE BEARINGS

MICROMETER WHEEL FEED

MACHINES of WAR.... FOR MACHINES at WAR....

Fosdick Radials



This is a war of machines—both at the front and at home. Thus it takes more and more machines — fast — efficient machines to keep our armed forces amply equipped.

This Fosdick Radial is drilling a 3 inch diameter pilot valve hole in the bed of a Chamfering Machine for a central states Machine Tool Manufacturer.

On this Fosdick Radial—centralized control—ease of operation—wide range of feeds and speeds instantly available—all contribute to speeding up production of vital machines for War.

Whether your operation is drilling — reaming — boring — tapping—facing or one of a dozen other operations—if it can be done on a Radial it will pay you to consider a Fosdick Economax Hydraulic Radial.

Full descriptive bulletin upon request. Ask for Radial Bulletin R.A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI · · · OHIO

DON'T BLOCK THE TRAFFIC!

Petty arguments only delay the more important tasks at hand. Friction destroys both men and machines; it blocks the traffic.

The most important traffic lanes right now lead to the front lines where men are pulling together to defend the cause of freedom.

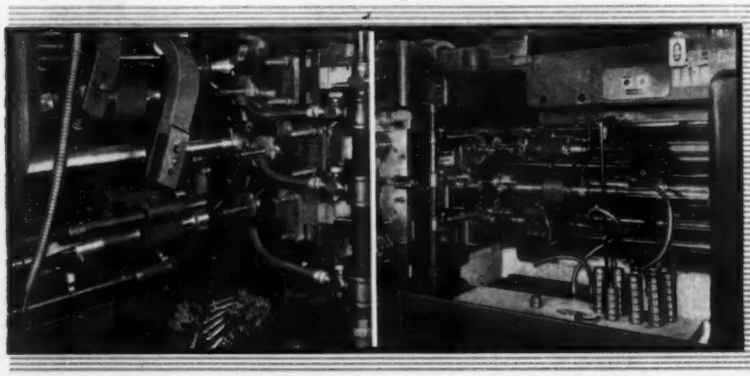
It is the job of those behind the lines to keep supplies rolling into these great traffic lanes, faster and in greater volume. It is the job of mass production.

Conomatics and their operators are working 24 hours a day, 7 days a week, producing parts vital to defense. These sturdy, accurate, fast, volume-producing machines, like the country in which they are built, are symbols of Unity — Stamina — Action.

Write, wire, or phone for information on Conomatics.

Shell bodies coming from 8-spindle Conomatic

Fuse bodies coming from 6-spindle Conomatic



CONE

AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT

The whirring of pulleys and belts . . . the meshing of gears . . . the hum of mechanical power producing war material on an unparalleled scale . . . in practically every factory in the United States . . . 'round all the hours of the clock—

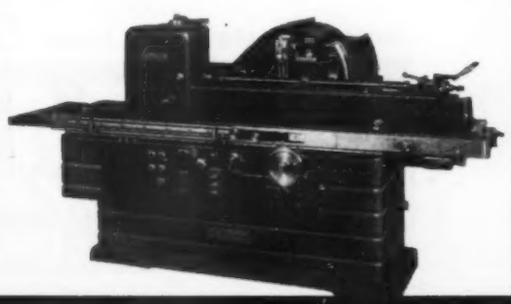
—this is the real battle cry of American industry . . . employees and employers together . . . as it lines up on the vast production front—

—a sure sound of Victory!

It has long been the predominant sound in all of the plants of Ex-Cell-O Corporation, where, day and night, thousands of skilled workers . . . loyal soldiers in overalls . . . are producing precision machine tools, cutting tools, precision-made parts, all in aid of this country's vital war effort.

EX-CELL-O CORPORATION • DETROIT

Below: Ex-Cell-O Precision Thread Grinder—Style 35-L . . . one of nine standard machines being widely used to produce highly accurate threads on hardened metal parts for the aircraft and other industries.



XLO

EX-CELL-O *means* PRECISION

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

SELECTOR DIAL CONTROL

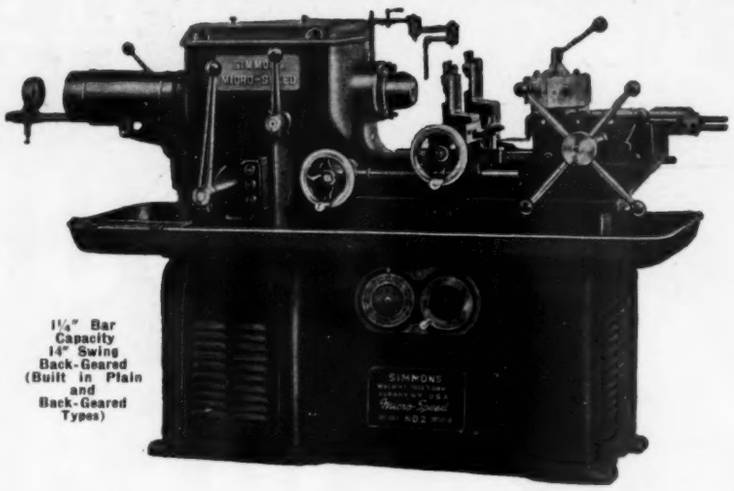
SIMMONS NO. 2 TURRET LATHE

Micro-Speed Drive

This versatile turret lathe, designed to give you higher precision and faster production, is being turned out at our plant in increasing numbers, thanks to our expanded production program.

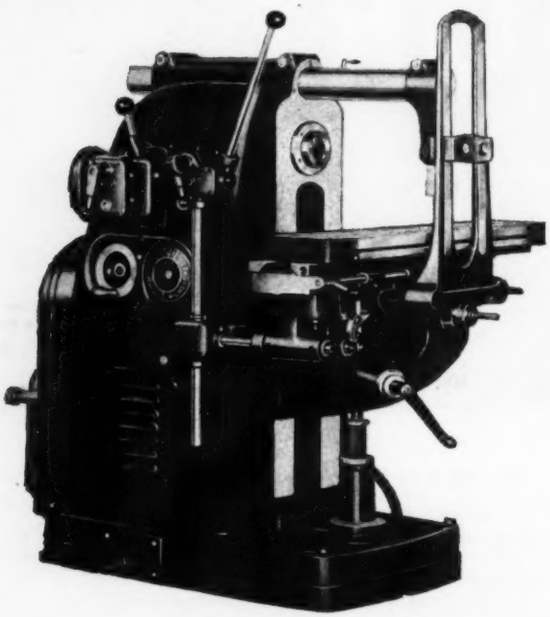
Equipped with Micro-Speed Drive (our own variable speed transmission) and Selector Dial Control by which speed changes are made instantly, at the turn of the handwheel adjacent to the Selector Dial on the cabinet base, Simmons No. 2 Turret Lathe is being used in major war production plants all over the country.

Write TODAY for new illustrated bulletin.



1¼" Bar Capacity 14" Swing Back-Geared (Built in Plain and Back-Geared Types)

SIMMONS NO. 1A MILLING MACHINE



Micro-Speed Drive

Today's intricate weapons of war call for small precision parts in tremendous quantities. Simmons No. 1A Milling Machine is ideal for that type of production. And because of expanded production facilities, Simmons can guarantee one month delivery.

The Simmons Micro-Miller equipped with our own variable speed drive and spindle brake, offers a wide range of speeds (56 to 630 RPM) any of which may be instantly obtained by a turn of the handwheel adjacent to the Selector Dial on the column. Result? The Right Speed For The Job. And that means higher precision . . . faster, more economical production!

Speeds: 56 to 630 R.P.M.;
Feeds: Longitudinal, 34"; Cross, 8"; Vertical, 18½"

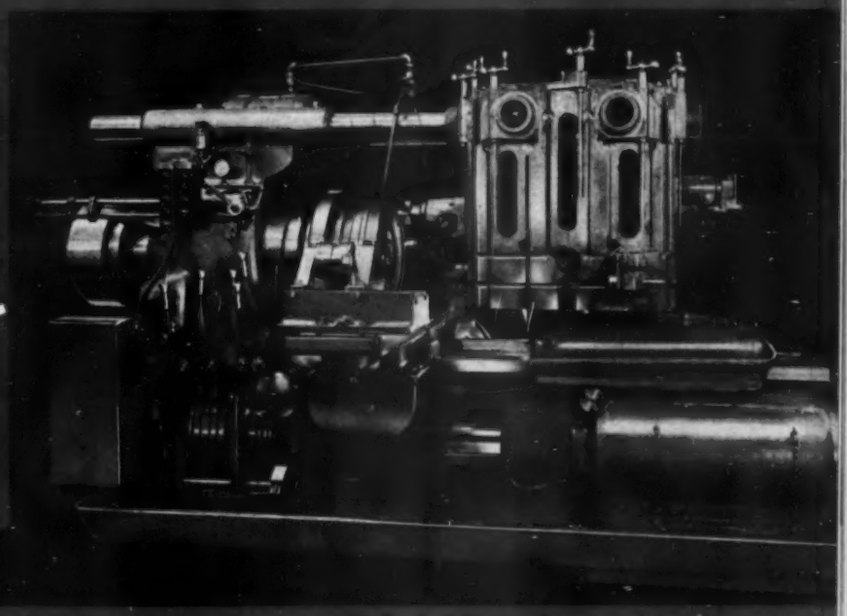
Write TODAY for new illustrated bulletin.

SIMMONS MACHINE TOOL CORP., 1759 NORTH BROADWAY, ALBANY, N. Y.

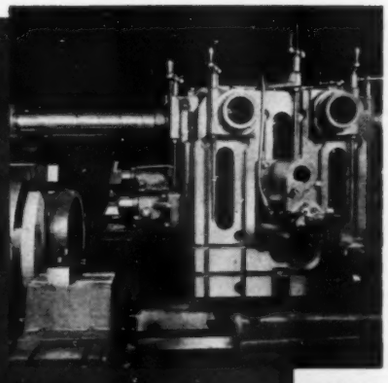
SIMMONS
MICRO-SPEED
REG. U.S. PAT. OFF.
LATHES · TURRET LATHES · MILLERS · BORING MACHINES

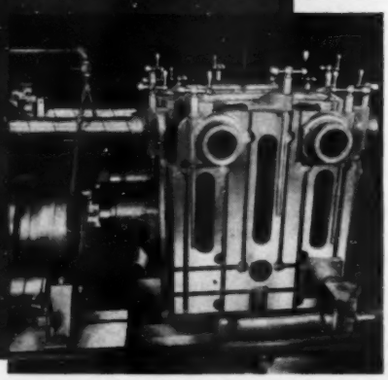
Results from planned production...

on a P&J 7D AUTOMATIC



*Fast and accurate rough and finish machining of locomotive axle Timken bearings





The operations performed on the Potter & Johnston 7-D Automatic shown here include the first, second and third settings to produce double cones of forged steel for large Timken Bearings to be used on locomotive axles.

Through the use of special tooling developed by P&J engineers and a rigid type of overhead pilot, this P&J machine handles a difficult job with utmost accuracy on a high production basis.

Although no output rate can be published, performance is such as to justify the general permissible statement that production is unusually high with operating costs an absolute minimum.

In addition to their high productive capacity, P&J Automatics can be depended on for flexibility, ease of change over, rigidity and high finish accuracy. On the class of work shown here one operator can readily handle a battery of these machines.

THE JOB AND HOW IT IS HANDLED . . .

PART — Forged steel double cone for Timken Bearings; outside diameter $19\frac{17}{32}$"; bore 17".

FIRST OPERATION

1st T.F.—Rough bore, turn large O.D. or center rib also small O.D. rib and raceway with 3 or 4 tools; rough face from cross slide.
2nd T.F.—Finish bore and radius; finish face from cross slide.

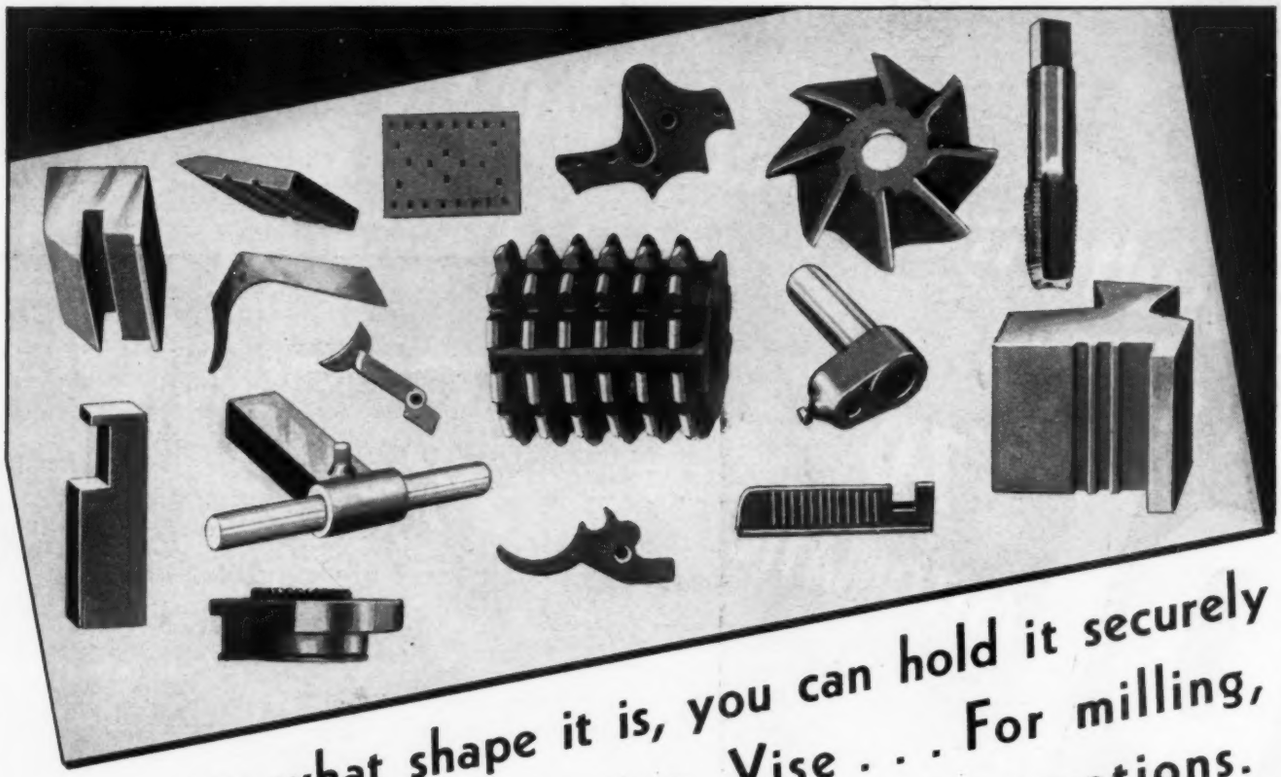
SECOND OPERATION

1st T.F.—Rough O.D. small rib, also rough raceway with 3 or 4 tools; rough face from cross slide.
2nd T.F.—Rough large rib under cut; rough form O.D. with circular tool from cross slide.
3rd T.F. — Finish undercut center rib and radius bore; finish form and finish face from cross slide.

THIRD OPERATION

1st T.F. — Undercut center rib.

PAWTUCKET · POTTER & JOHNSTON MACHINE CO. · RHODE ISLA



No matter what shape it is, you can hold it securely in the Fenn Quick Action Vise . . . For milling, drilling, tapping and assembling operations.

FENN

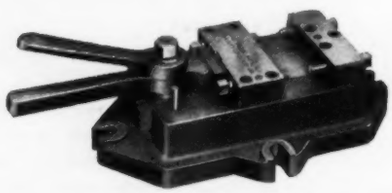
For Speed and Power

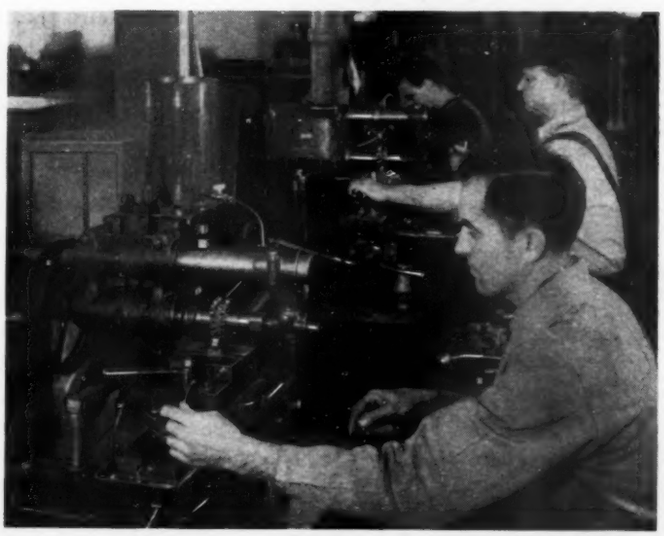
The Fenn Vise is used in hundreds of plants working on small parts—production. Its quick-action plus gripping power makes it especially adapted for holding small parts where accuracy and precision are essential.

The powerful levers instantly pull the jaws together and hold the work in a grip that is far beyond any pressure exerted by the ordinary crank operated vise.

When the jaws of a FENN come together they take hold uniformly. There is no unevenness to the grip whatever. This can be demonstrated by clamping two pieces of paper —.001 of an inch in thickness—one at each end of the jaws. The grip is even on both pieces of paper.

Send for Bulletin #10 today.





THE FENN MANUFACTURING COMPANY

HARTFORD, CONNECTICUT • ESTABLISHED 1900

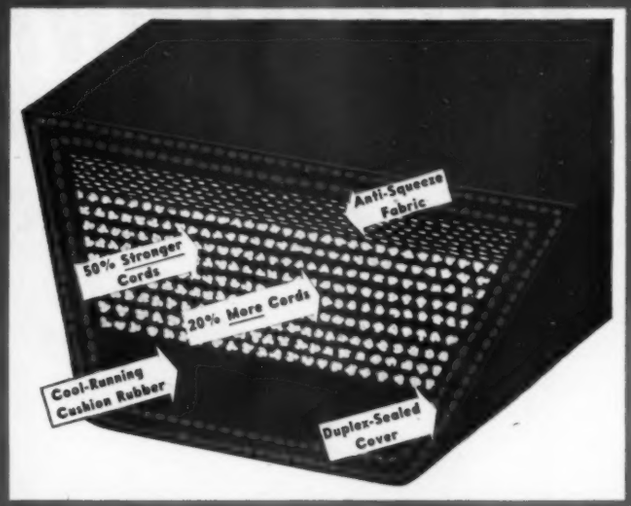
TEXROPE* SUPER-7 GIVES YOU THREE LIFETIMES IN ONE!

1 **50% STRONGER CORDS!** Sensational new Flexon process makes cords 50% stronger than ever, those in former great Texrope belts.

2 **20% MORE CORDS!** Count them! You get 20% more of these tough, extra pulling power cords in every Texrope Super-7.

3 **INCREASED LIFE!** Cords float on amazing cool-running cushion rubber that absorbs shock . . . actually increases belt life phenomenally.

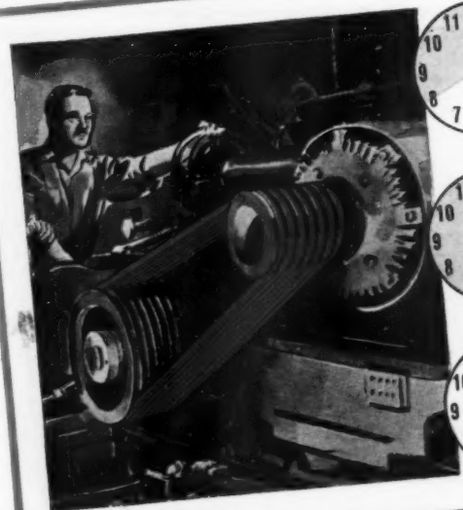
4 **EXTRA PROTECTION!** Exclusive duplex-sealed cover protects pulling cords against dirt, grit, moisture, and other adverse elements.



ALL THEY used to ask of power transmission was one-shift-a-day . . .

NOW it's *three* top-speed shifts, seven days a week, in plants all over the country! Yes — and it's the extra built-in strength of the new Allis-Chalmers Texrope Super-7 V-belts that lets you get these *three lifetimes in one!*

50% stronger cords! 20% more load-pulling cords! That's the kind of news hard-pressed operators like to hear today.



8 to 4 SHIFT!
Texrope Super-7 V-belts give you smooth, silent, slipless, high-efficiency performance to do a completely dependable wartime job!

4 to 12 SHIFT!
Texrope Super-7 V-belts still going strong . . . with rubber shock-absorbing section helping to keep belts cool even when operating continuously.

12 to 8 SHIFT!
With load-pulling cords 50% stronger, and 20% more of them, Super-7 V-belts have extra built-in strength to give you "three lifetimes in one."

And there's more to the Super-7 story. There's the new rubber shock-absorbing section that helps keep belts cool even when operating *continuously.* There's the duplex-sealed cover for extra protection against grit, dirt, and moisture.

Don't forget — Super-7 is the newest V-belt on the market . . . it's stronger, longer-wearing, with top transmission efficiency . . . and it's four ways better!

If you want a V-belt that will give you "three lifetimes in one," see your Texrope dealer or the engineer in the Allis-Chalmers district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin.

Available in all sizes
½ hp to 2,000 hp

A 1497

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the co-operative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers.

INDUSTRY SHOOTS PRODUCTION MINUTES

MICROHONING MAKES MORE HITS

SAVE TIME
★
SAVE METAL
★
SAVE COST
★
IMPROVE QUALITY
★
WITH MICROHONING

DIESEL•••—

24" Microhone for Diesel engine liners. Extra miles per hour in submarines, mine sweepers and similar marine engines require the controlled accuracy provided by Microhoning.

ORDNANCE•••—

Draw Finish Microhones. These provide a finish in recoil chamber and other bores with all machining marks co-directional with the axis of the bore. Simulating a mechanical wearing in process—this type of honing shortens or eliminates "wearing in" in service.

ORDNANCE•••—

Large Microhones for gun barrels.

Micromatic Hones have lowered the time required for final sizing and surface finishing operations from days and hours to minutes and seconds.

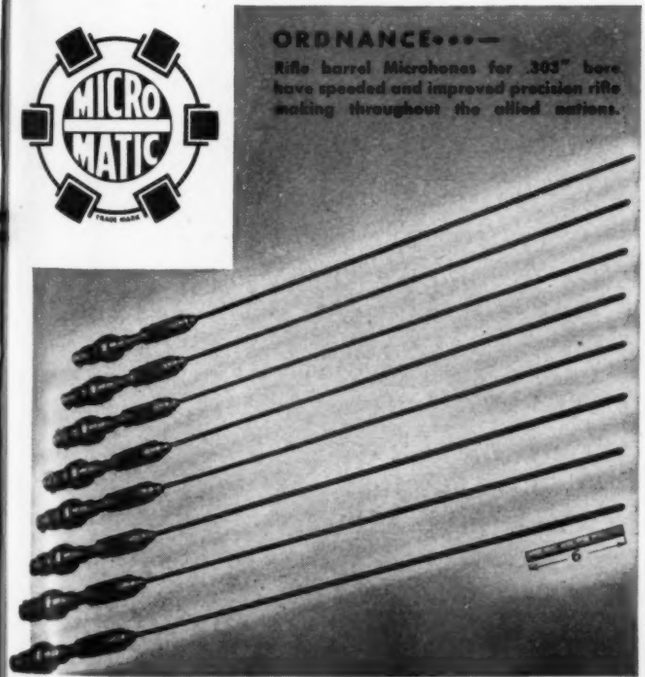
Microhoning saves TIME COST—METAL REMOVAL—MANUFACTURING COST—AND IMPROVES PRODUCT QUALITY; which, combined, means more target hits in the tough service of WAR.

Micromatic Hones range from sizes for bores .303" to 25½" in diameter—from ¼" to 900" long. They generate geometrical and dimensional accuracy, uniform size and any desired surface finish with minimum removal of stock.

ORDNANCE•••—

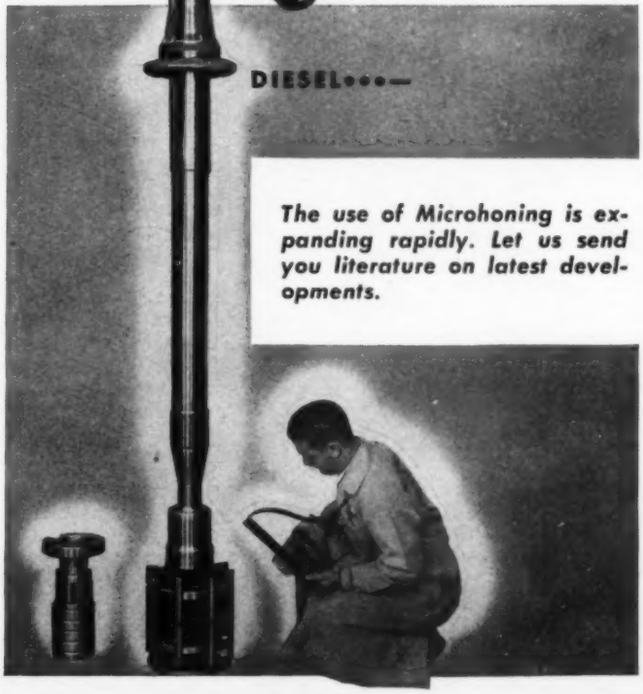
MICROMATIC HONE CORPORATION

1345 E. MILWAUKEE AVE. • • • DETROIT, MICH.



ORDNANCE•••—

Rifle barrel Microhones for .303" bore have speeded and improved precision rifle making throughout the allied nations.



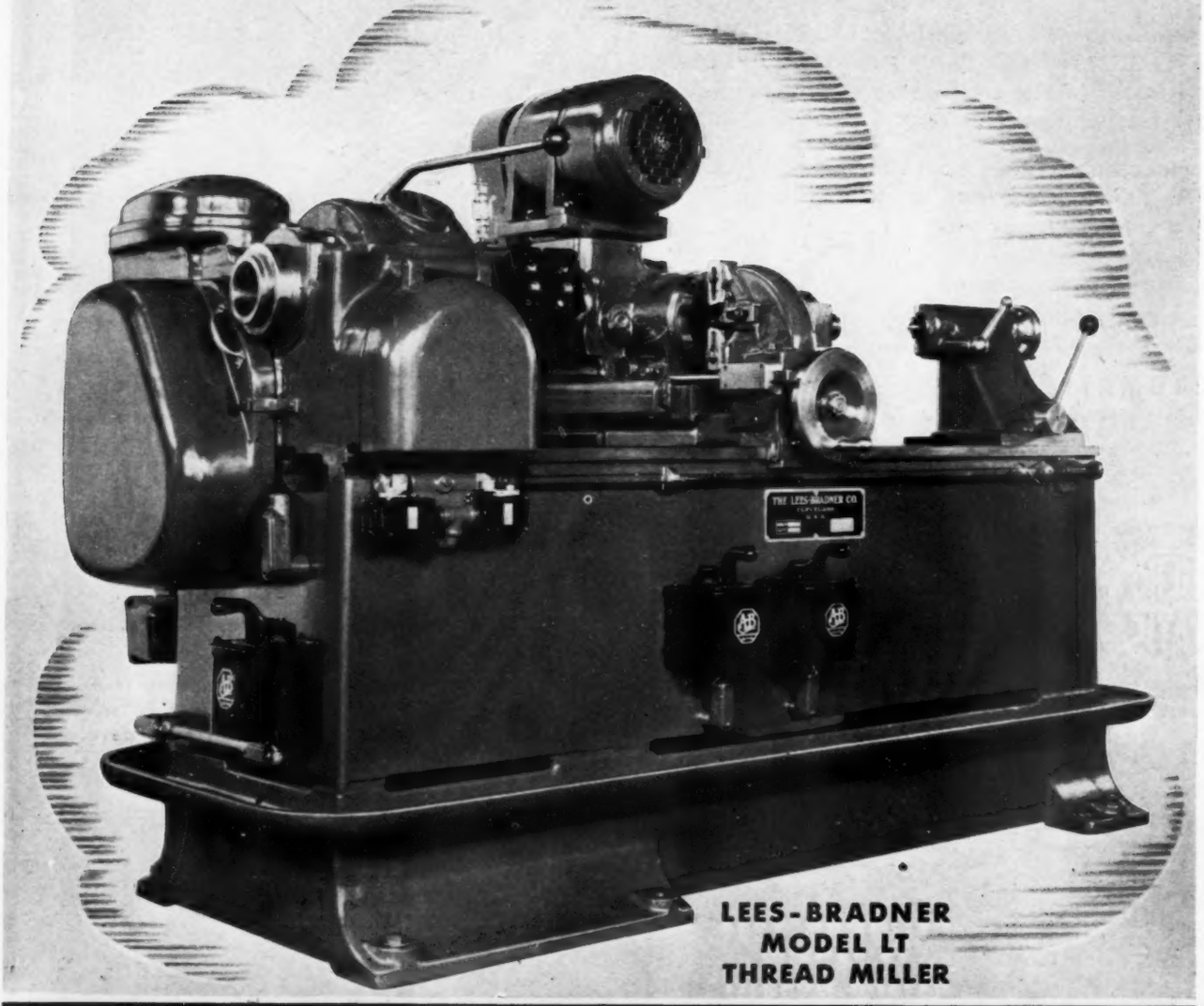
DIESEL•••—

The use of Microhoning is expanding rapidly. Let us send you literature on latest developments.

For Speed – Finish – High Production

LEES-BRADNER *Thread Miller*

Where superb threads of extreme accuracy, in large or small lots, are the requirement, put the job on a Lees-Bradner Model LT Thread Miller with complete confidence as to results.



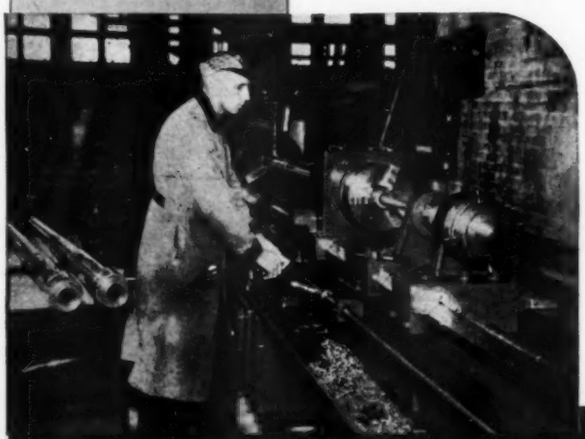
LEES-BRADNER MODEL LT THREAD MILLER

The **LEES-BRADNER** *Company*

CLEVELAND, OHIO, U.S.A.

No. 2 GUN RIFLING MACHINE

. . . One of a Complete Line of Gun Manufacturing Machines by LeBlond



One of the greatest improvements in gun manufacturing equipment — the application of hydraulic pressure on internal surfaces — is an outstanding feature of the LeBlond No. 2 Gun Rifling Machine. The powerful hydraulic drive provides quick, positive control.

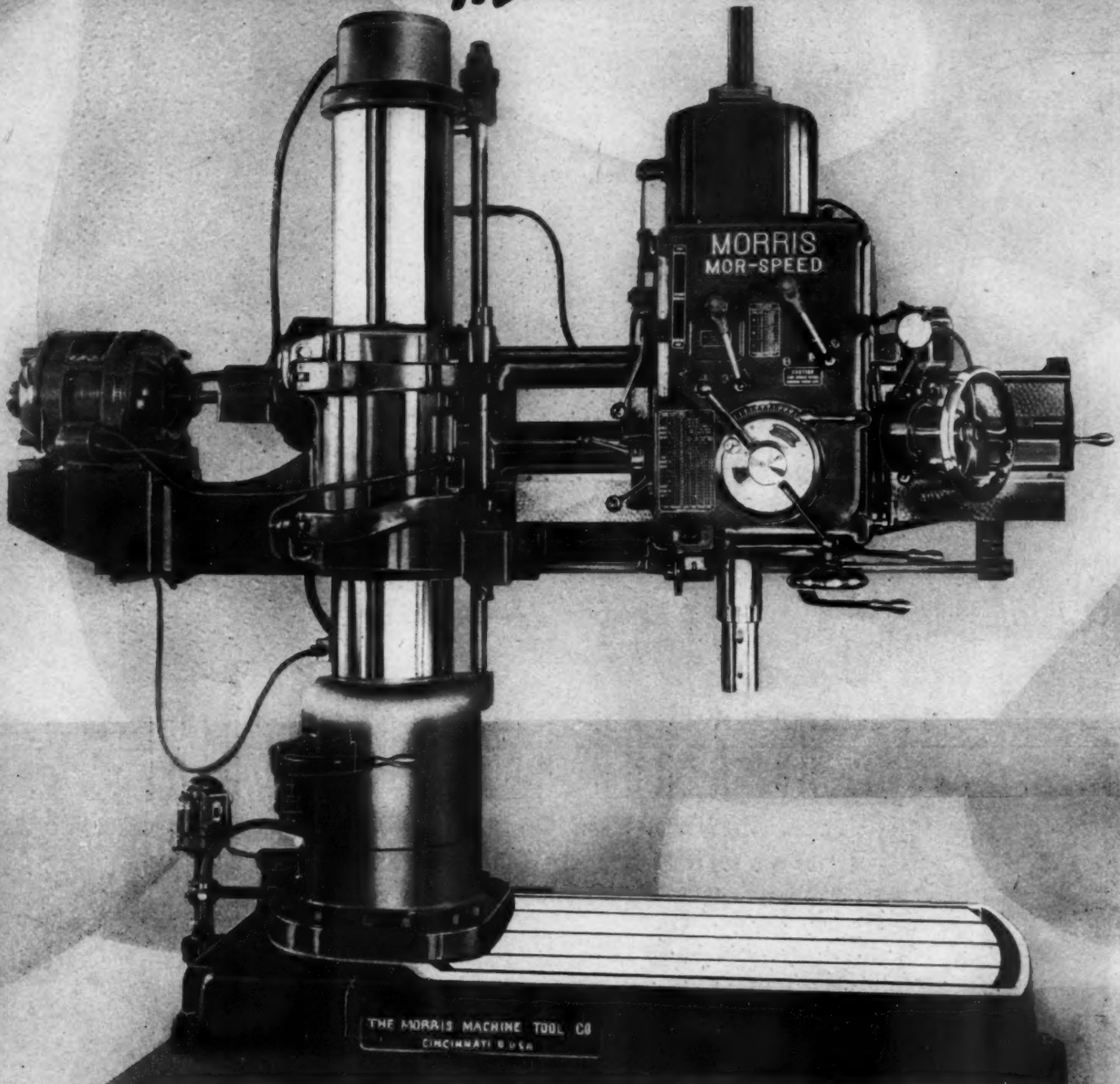
The No. 2 rifles maximum bore 40 mm, up to 88 inches in length, not over 10-foot stroke . . . equipped with automatic indexing head . . . swing over bed ways 15 inches.

THE R. K. LeBLOND MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

Largest Manufacturer of a Complete Line of Lathes

MORRIS *Mor-Speed* RADIAL



Speed and stamina to meet the heavy demands of War production are "built in" this Morris 13 inch column Radial Drill. Centralized control, power and ease of operation assure maximum output and speeding up of drilling — facing — boring and tapping operations.

Here is a Radial containing all the modern construction features productive of accurate high speed work. All feed and speed changes in the head . . . electric column clamp . . . automatic lubrication . . . alloy steel gears, shafts, spindle and spindle sleeve are a few of its many points of advanced design. For complete details, write for Circular No. 101.

PRATT & WHITNEY exclusive representative for U. S. A.

Builders of MOR-SPEED *Radials*

The MORRIS *Machine Tool Co.*

CINCINNATI, OHIO

A battery of South Bend Lathes producing airplane engine valves.

"How to Run a Lathe"

USE THIS BOOK FOR APPRENTICE TRAINING

A practical reference book on lathe operation for beginners and apprentices. 128 pages, 5⅛" x 8". Price 25c, postpaid.

Where Production Calls for Precision

PRODUCTION for National Defense calls for precision. There can be no sacrifice in accuracy—even with the urgent demand for quick deliveries in vast quantities and the resultant speeding up of production schedules. And all work *must* pass inspection—there can be no scrapping of strategic materials—no delay in delivery—no wasted man power or machine time.

In hundreds of defense industries, precision keeps pace with production, through batteries of South Bend Lathes—like those shown above.

Modern in design, built with extreme precision, South Bend Lathes are fast and accurate on the most exacting classes of machine work. Their wide range of spindle speeds permits machining with maximum cutting tool efficiency. Their versatility facilitates quick change-over through a minimum of set-up time.

South Bend Lathes are made in five sizes: 9", 10", 13", 14½", and 16" swing, with toolroom or regular equipment. Also turret lathes for multiple tool production operations. Write for catalog and the name of our nearest dealer.

NAVY "E"

Awarded to the South Bend Lathe Works for outstanding performance in the production of ordnance matériel for the United States Navy.

TRADE MARK SOUTH BEND ENGINE LATHES

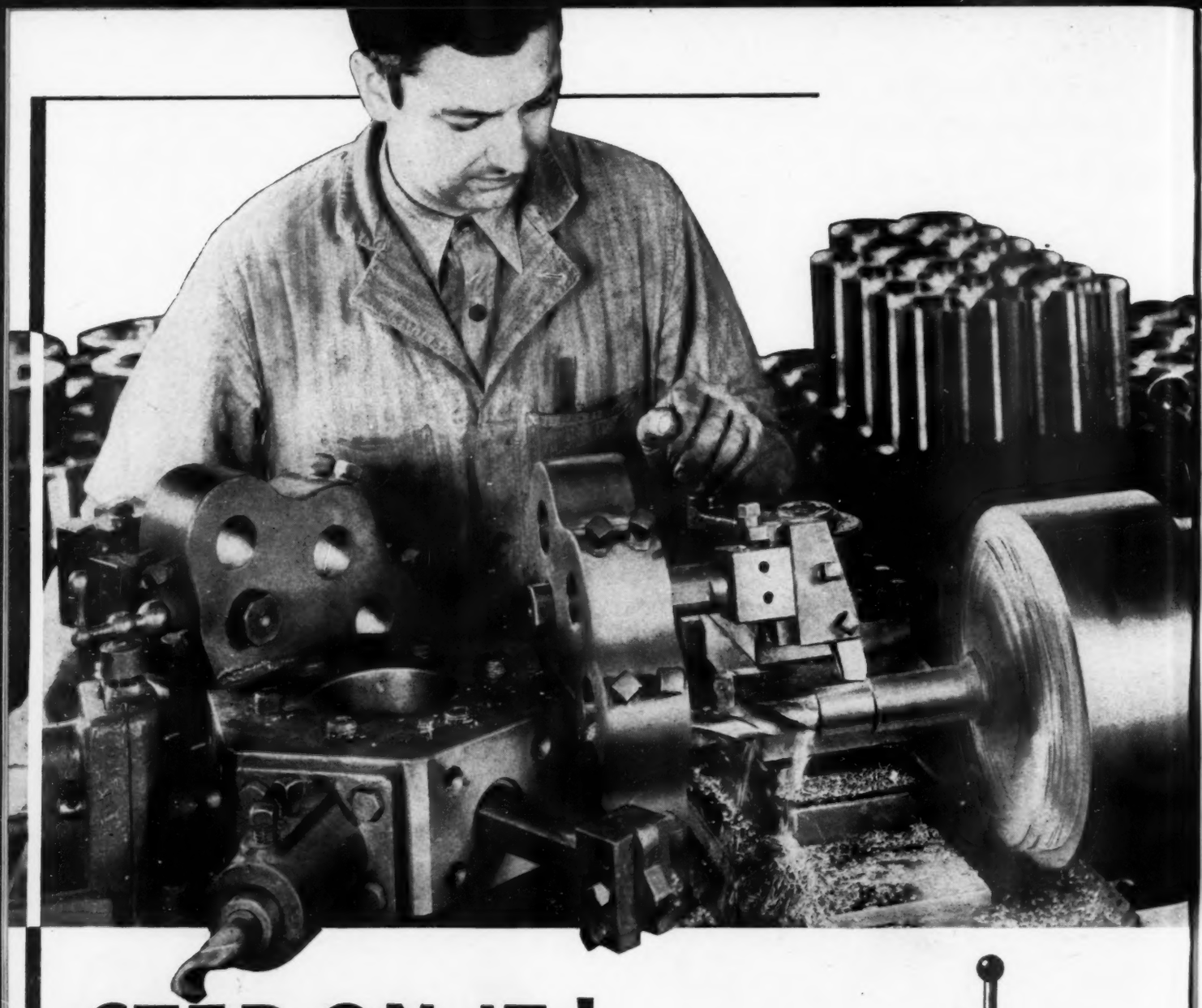
SOUTH BEND LATHE WORKS

278 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

LATHE BUILDERS FOR 35 YEARS

AMERICA'S
PLANES

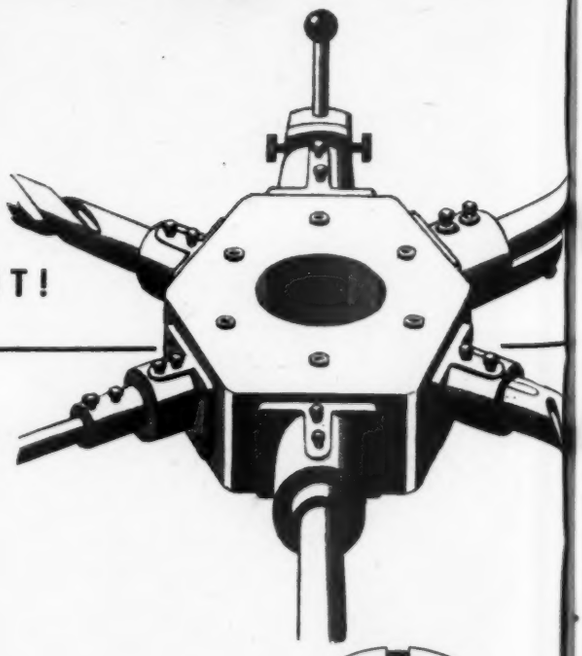
EVERY ONE
IS POWERED BY
AN ENGINE THAT
BULLARD
HELPED TO
BUILD
THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT
BULLARD



STEP ON IT!

168 hours a week!

THE GISHOLTS ARE BUILT FOR IT!



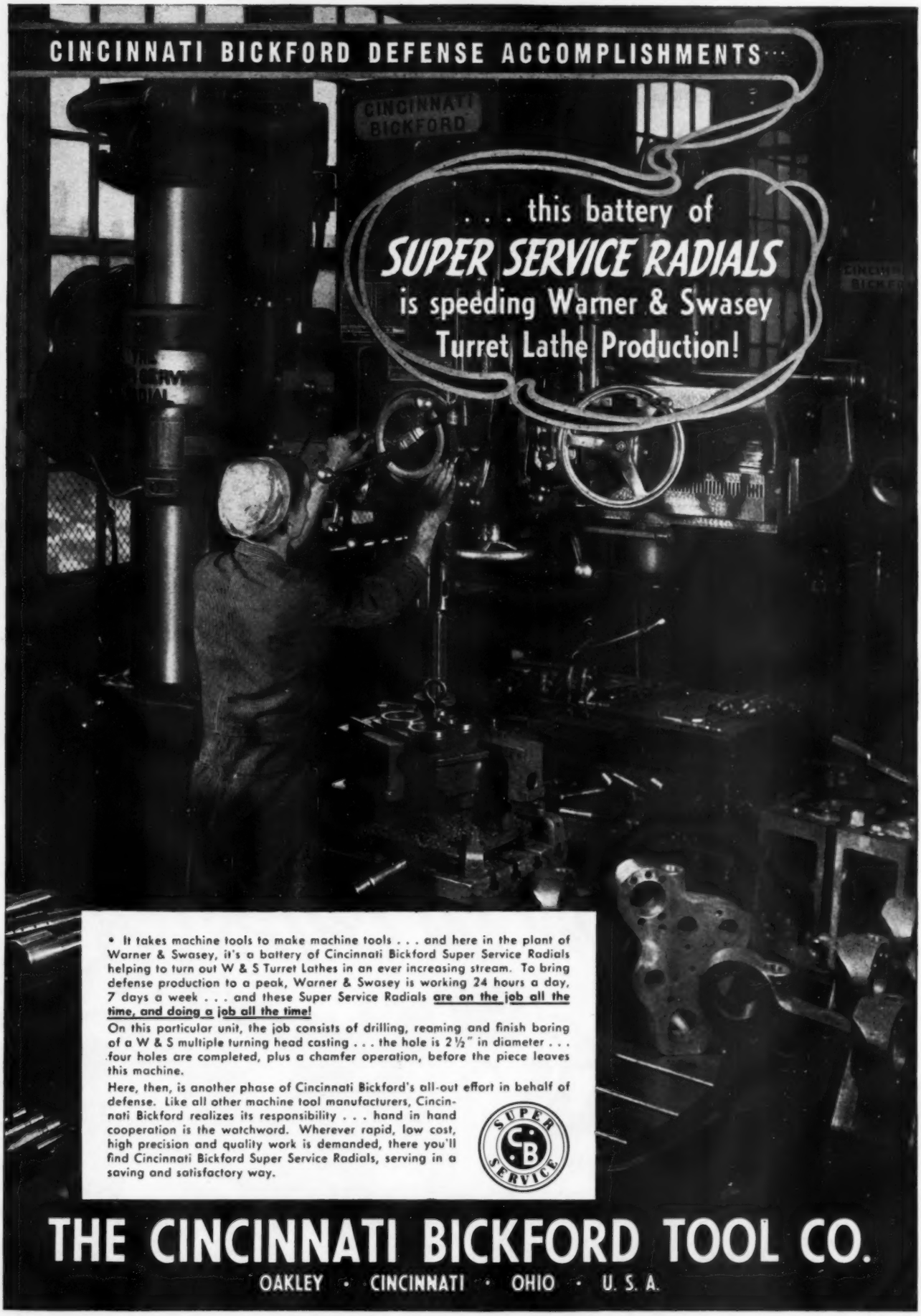
WHILE we cannot speak for all machine tools, we do speak for those that bear our name. Go ahead and crowd your Gisholts! They're built to take it—to keep on producing around the clock, seven days a week, if need be. Keep 'em turning full speed—full time!

GISHOLT MACHINE COMPANY
1201 E. Washington Ave., Madison, Wis.

LOOK AHEAD • KEEP AHEAD • WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

GISHOLT


CINCINNATI BICKFORD DEFENSE ACCOMPLISHMENTS···
CINCINNATI BICKFORD
. . . this battery of
SUPER SERVICE RADIALS
is speeding Warner & Swasey
Turret Lathe Production!
• It takes machine tools to make machine tools . . . and here in the plant of Warner & Swasey, it's a battery of Cincinnati Bickford Super Service Radials helping to turn out W & S Turret Lathes in an ever increasing stream. To bring defense production to a peak, Warner & Swasey is working 24 hours a day, 7 days a week . . . and these Super Service Radials are on the job all the time, and doing a job all the time!
On this particular unit, the job consists of drilling, reaming and finish boring of a W & S multiple turning head casting . . . the hole is 2½" in diameter . . . four holes are completed, plus a chamfer operation, before the piece leaves this machine.
Here, then, is another phase of Cincinnati Bickford's all-out effort in behalf of defense. Like all other machine tool manufacturers, Cincinnati Bickford realizes its responsibility . . . hand in hand cooperation is the watchword. Wherever rapid, low cost, high precision and quality work is demanded, there you'll find Cincinnati Bickford Super Service Radials, serving in a saving and satisfactory way.
SUPER SERVICE
THE CINCINNATI BICKFORD TOOL CO.
OAKLEY · CINCINNATI · OHIO · U. S. A.

GET
MORE PRODUCTION
FROM OLD and NEW
TURRET LATHES
THERE are many ways we can help you: Newer, better tools for turret and cross slide; improved spindle accuracy with new collets; turret lathe rebuilding instruction; develop new tooling setups; job studies and turret lathe department study by our field service men and sales engineers; Operator's Service Bureau offering learner courses; Operator's Manual; cutter grinding sound-movie; special operator bulletins, "Blue Chips". Write —
WARNER & SWASEY
Turret Lathes
Cleveland
THEY KNOCKED THE CHIP
OFF UNCLE SAM'S SHOULDER!
OK! LET'S SHOW 'EM CHIPS!

WHAT'S IN THIS ISSUE

PETER L. BUDWITZ

DR. GEORGE SCHLESINGER

C. E. SMITH

GEORGE SCHERR

HIGH-SPEED SAVINGS

Any suggestion for saving high-speed steel is welcome in the face of the current shortage. Peter L. Budwitz has some excellent ideas for making built-up taps, reamers and counterbores with machined steel shanks and high-speed steel cutting edges. Page 384.

AUTOS TO AIRCRAFT

The automobile industry's 100 percent switch to war products will turn a large part of its facilities over to the manufacture of aircraft. A notable example is Buick, now engaged in the production of a high-powered radial aircraft engine. The application of automotive methods to this field was made with an eye to rising schedules. Page 393.

A HEAD FOR CAMS

A second article on cam milling is contributed by H. A. Frommelt, director of industrial research, Kearney & Trecker Corporation. Of the many methods for performing this operation, he now discusses those using the dividing head. As cams are used in many war products, this series has a timely interest. Page 386.

WARMING UP

With today's emphasis on accuracy in making many war products, a series of tests conducted by Dr. George Schlesinger, director of research, The Institution of Production Engineers, London, is of interest. Dr. Schlesinger has found that there are marked changes in the alignment of machine tools during the warming-up period. He has measured these changes and gives recommendations for avoiding ill effects from them. This article is especially significant because of the author's wide reputation as an authority on metal working. Page 379.

WELDS IN ALUMINUM

The enormous expansion of the aircraft industry has developed many new techniques of manufacture, including methods for making resistance welds in aluminum alloys. The general procedure is to store up electrical energy and release it in surges in order to achieve the desired results. The two means of doing this commercially are explained by C. E. Smith, Westinghouse Electric & Manufacturing Company. Page 375.

GUNS AND GIRLS

A Canadian manufacturer, faced with the job of making three types of machine guns with a limited supply of skilled labor, turned to work simplification as a solution. By breaking operations into elementary tasks, he succeeded in employing many green hands on precision work. Today two-thirds of the working force are women. Page 404.

MAKING BLADES LAST

Razor blades are not the only ones threatened by the tool steel shortage. Hacksaw and bandsaw blades must also be made to last as long as possible; in fact they are even more important because of their part in making war products. Two Reference Book Sheets tell of blade failure, its cause and correction. They are part of the Disston Tool Conservation Plan. Page 409.

SPEED NOT EVERYTHING

In our rush for production, we should not forget quality. George Scherr, president, George Scherr Inc., points out this fact, calling attention also to the low-priced measuring instruments, capable of splitting thousandths, that are available to the small shop. Since subcontracting is often limited by a shop's ability to work to close tolerances, his recommendations should be extremely helpful. Page 389.

CONVERSION

Right now the process of conversion is at its peak. Some plants have already made the switch to war products, some have not yet started, but in general the move is in full swing. A spread of cartoons offers some helpful hints on the subject. Page 382.

COMING

Plastics have become so intimately associated with metals in various products of peace and war that they are already familiar to the machine shop. As a rule they are not difficult to cut, but for best results, a special technique should be followed. An article to appear in an early number will give some practical information on machining laminated plastics.

Continuing our spreads of sketches on typical tool elements by John G. Jergens, another pair of pages devoted to expanding arbors will appear shortly. Judging from the widespread interest in these articles they are proving to be of value to vocational schools and training courses as well as of practical interest to the man in the shop.

Cincinnati
ACME
UNIVERSAL
TURRET LATHES

26% TIME SAVED FOR CINCINNATI PLANER!

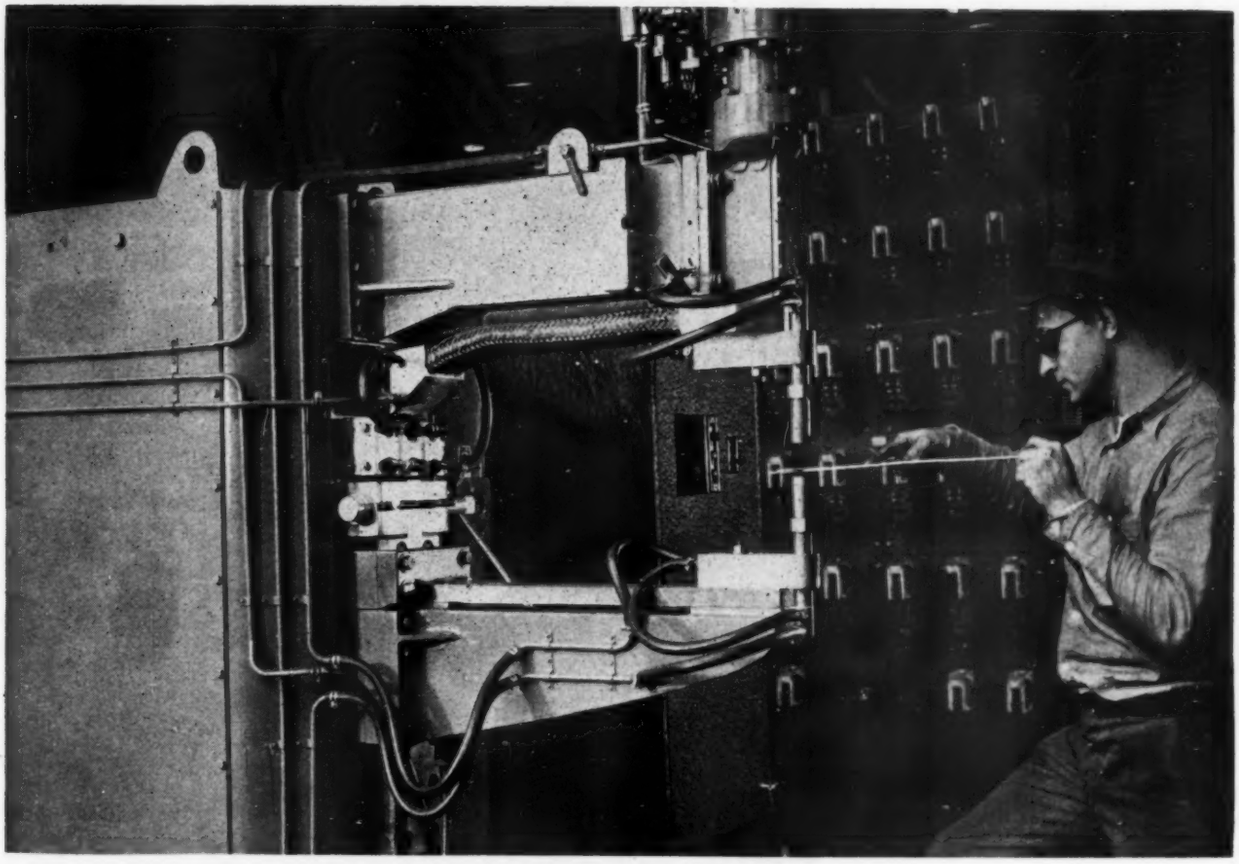
The two CINCINNATI ACME Universal Turret Lathes shown above are in the plant of the Cincinnati Planer Co. The one in the foreground is rough turning bevel gears, and doing the job, according to Cincinnati Planer's records, at an average time saving of 26%. The machine is a No. 3S CINCINNATI ACME Universal Turret Lathe having a 4½" bar capacity with a 26½" swing over vees, 24½" over carriage wings and 18½" over bridge of cross-slide.

Design features that assure an abundance of power and rigidity for carbide tool cutting and wide feed and speed ranges for fast, productive cutting, are the qualities that give CINCINNATI ACME Universal Turret Lathes the ability to meet current production demands profitably, accurately and efficiently.

Write for Bulletin G-102 for a full description or consult our engineering staff on any problem of turret lathe production.

...The ACME MACHINE TOOL CO.,
... CINCINNATI, OHIO.

ESTABLISHED 1877 AMERICAN MACHINIST BURNHAM FINNEY, Editor



An operator places two pieces of metal between the electrodes of a stored energy welder

Stored Energy Welds Aluminum

BY C. E. SMITH, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Welding aluminum requires a quick, intense fusion heat and subsequent cold working; stored energy does the job with lower peak loads than ordinary welders

ONE OF THE LATEST developments in resistance welding, particularly in the field of high-conductivity metals and alloys, is the process of storing energy either electromagnetically or electrostatically, and then discharging it to produce a quality weld. The electrical energy is stored in a transformer or capacitor over a relatively long period of time and suddenly discharged into the material being welded.

In accordance with the law of conservation of energy, the sum of the electrostatic and the magnetic energies in any electrical system is constant if the system as a whole does not receive or give out any energy, or if energy is being supplied at the same rate at which it is being dissipated. But with these processes the energy is supplied over a much longer period than which it is dissipated.

Used generally in the welding of aluminum alloys in the aircraft industry, this new process accomplishes two very specific and worth-while objectives: It creates welds of more uniform characteristics with better surface appearances and of improved metallurgical soundness. It does so with these unique energy storing operations, with a peak power demand of about one-fourth that required by an equivalent a.c. spot welder.

When the material to be welded is placed between the electrodes of the welding machine and in position, an electrode pressure is applied. After the

materials have received this contact pressure the welding transformer is charged by d.c. current furnished by an ignitron rectifier. A certain charge is selected by the adjustment of a current relay upon whose action the contactor in the primary circuit is opened and secondary current flows (Fig. 1).

During the fall or decay of the secondary current electrode pressure is suddenly increased and held there until the heat period is completed and the material has fused. The result achieved is a mechanical working of the metals welded, which recompenses for the changes in grain structure of the material caused by the fusion heat.

The secondary current (Fig. 2) may be altered to suit certain welding conditions by the insertion of water-cooled resistance blocks in the secondary of the transformer. Since the time constant must follow the L/R (inductance divided by resistance) on appearance of the secondary voltage, the current wave is dependent on the secondary resistance in an inverse proportion. With a large amount of resistance the wave front (Fig. 3) will have a steeper rise and sharper fall. With an insertion of a lower resistance the wave front will not rise as rapidly and the decay will be much slower.

The magnetic welding process is based on the ability of a changing current to induce a voltage. Although the welder operates from an a.c. supply line, it is a d.c. process, employing d.c. obtained from an ignitron rectifier. The welding transformer secondary, through its property of mutual induction, supplies the heavy short-time welding current when the d.c. voltage to the primary of the transformer is suddenly interrupted. This short-time high-energy welding current is in reality a quick discharge of the energy which the d.c. operated transformer has absorbed over its long charging period.

An analysis of this energy storage phenomenon, and the use of d.c. in a transformer brings out some interesting fundamental facts. They revolve around the property of inductance, or the voltage inducing ability of an inductive circuit. If the voltage is induced in the same wire that carries the inducing current the circuit possesses self-induction. Self-induction gives momentum to the current, so it cannot be instantly stopped when the circuit is broken.

At the instant of closing the switch in Fig. 4 the current is zero and because of self-induction the current does not immediately rise to its maximum value E/R (voltage divided by resistance). As the time progresses the current increases more slowly until a steady value is reached and the effect of the inductance disappears. Kirchoff's laws state that the sum of potentials around this circuit is zero and is equal to zero at every instant when all potentials are accounted for. Accordingly, when the current is building up in the coil, the resistance drop and e.m.f. of self-inductance are opposed to the potential of the applied voltage. Then the current will reach its steady value E/R slowly, and the curve (Fig. 5) gradually reduces its slope as the resistance of the circuit uses more and more of the applied voltage reaching its steady state, the inductance is said to be completely charged and has absorbed a certain energy.

It takes time to set up current in an inductive circuit and similarly, after the

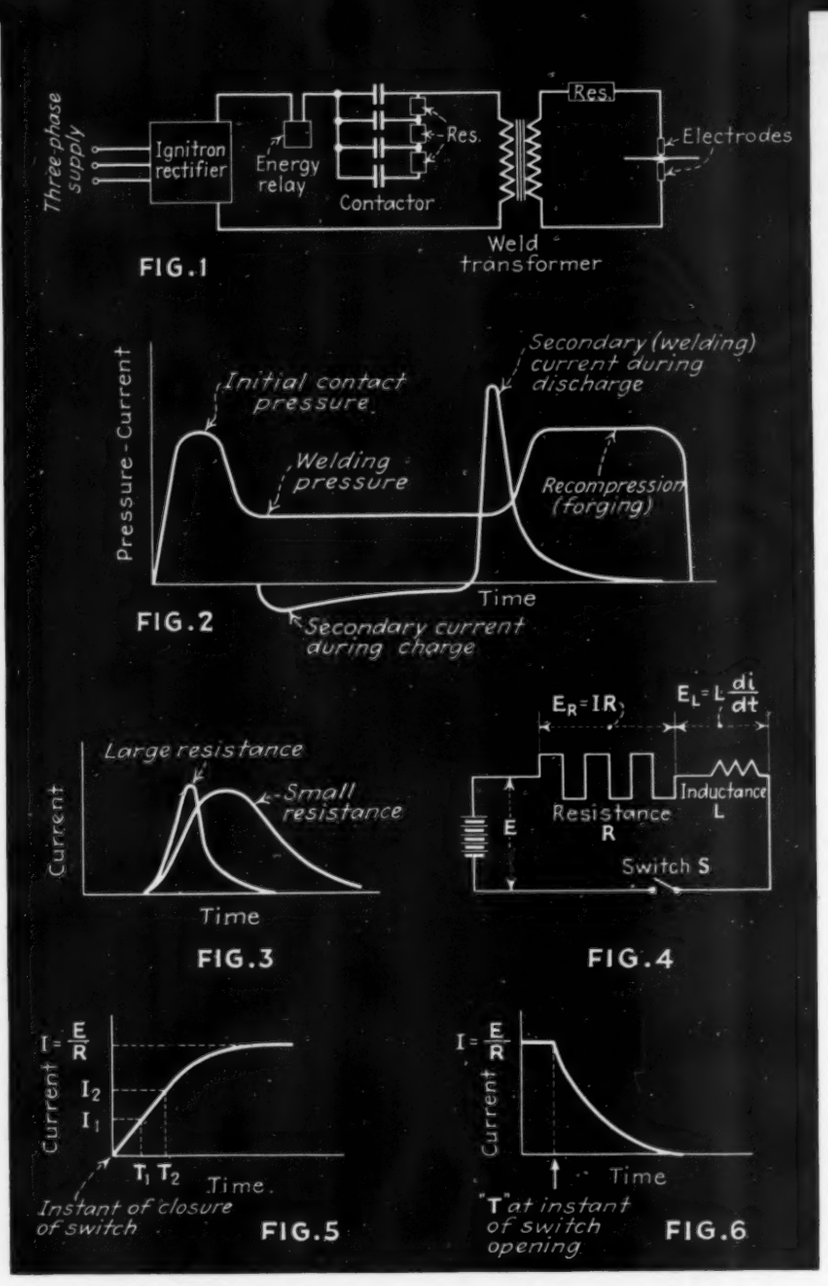


Fig. 1—The stored energy welder rectifies a three-phase supply to direct current which charges the weld transformer

Fig. 2—Sequence of the welding operation is shown by the curve of pressure and secondary or welding circuit

Fig. 3—Inserting resistance blocks in the circuit produces a larger rise and steeper fall of the wave front

Fig. 4—Because of self-induction current will not rise immediately to full value when the switch is closed

Fig. 5—The action of the charging current reduces the slope of the curve until the inductance is completely charged

Fig. 6—Inductance possesses a high-voltage supplying energy to maintain the current which causes a decaying period when switch is opened

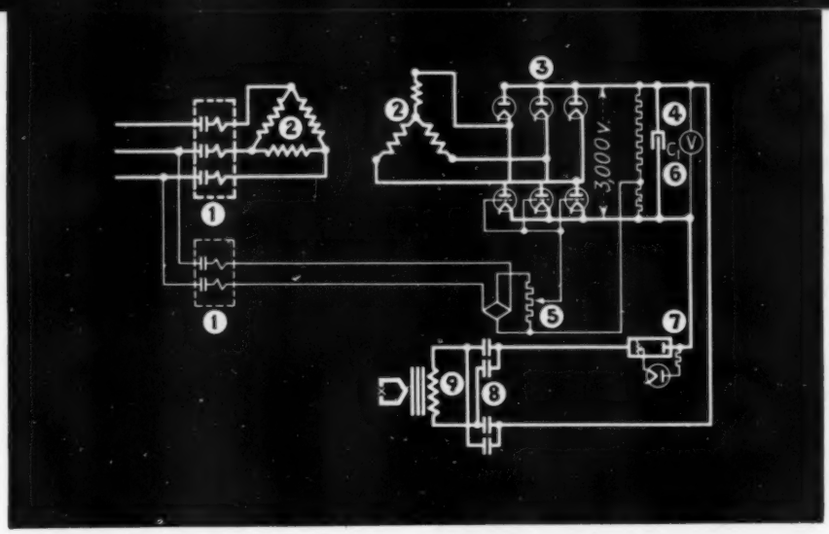


Fig. 7—A schematic diagram of the electrostatic stored energy system. (1) Breakers for control circuits. (2) Three-phase delta-Y rectifier transformer. (3) Three-phase, grid-controlled, full wave thyratron rectifier. (4) Energy storage capacitor bank. (5) D.C. voltage supply for capacitor charging voltage control. (6) Voltmeter. (7) Ignitron series tube—discharge capacitors. (8) Reverse polarity contactor—prevents saturation of welding transformer. (9) Welding transformer

Fig. 8—The discharge of the capacitor produces a sharp rise and fall of the secondary or welding current

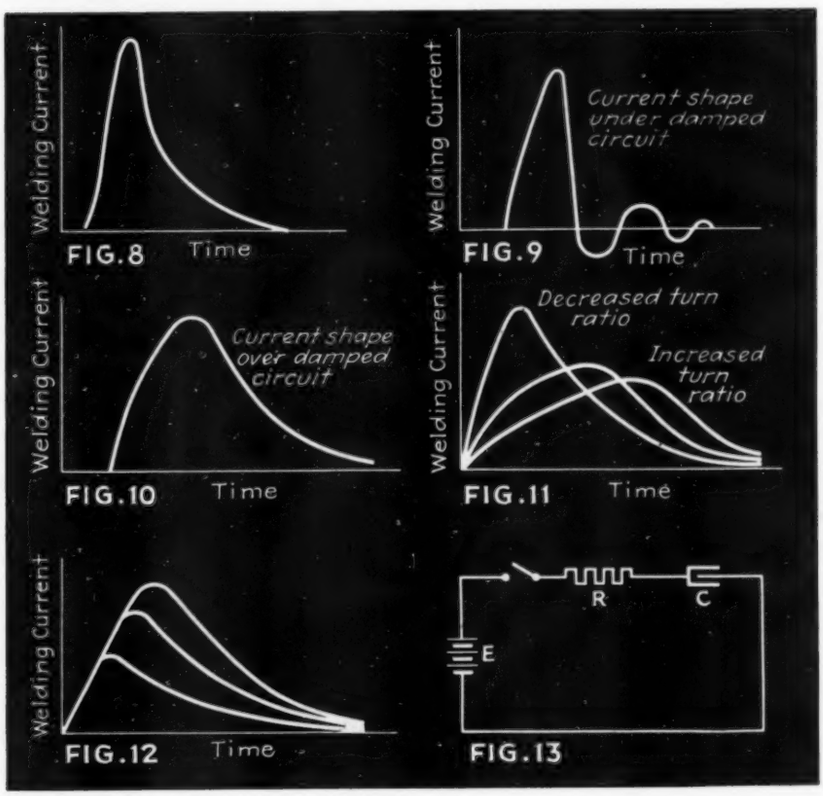
Fig. 9—When the resistance is low compared to the critical value $2\sqrt{\frac{L}{C}}$ an oscillating discharge is produced

Fig. 10—Oscillation is avoided by allowing the back voltage to appear on the multiphase rectifier tubes. This tends to broaden the current wave

Fig. 11—The wave shape is sharper with a decreased transformer turn ratio, flatter with an increased turn ratio

Fig. 12—The wave shape is affected by changes in the capacitance. Research should disclose the best wave shape for particular welding operations

Fig. 13—In this simple charging circuit, current reaches full value when switch is closed and then diminishes as the capacitor is charged

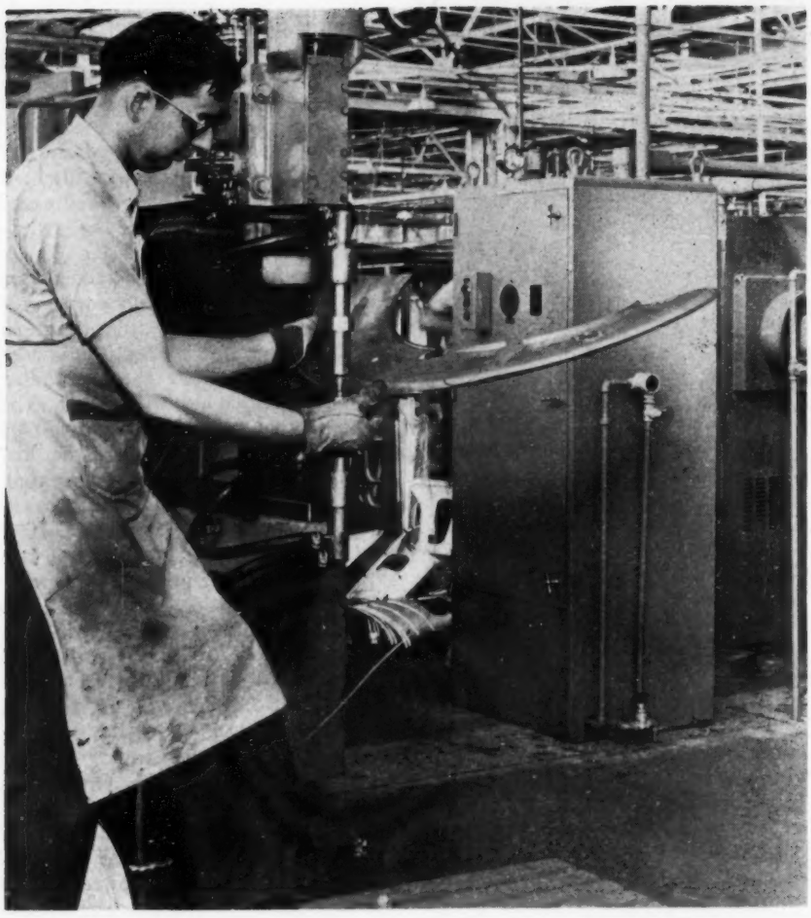


current is up to a value and the battery voltage removed, the current will persist for a period before coming to zero. After the coil in Fig. 4 has been charged if the switch is suddenly opened, or if the voltage source is removed and resistance R inserted in series with L, it will be found impossible to stop the current instantly. When the switch starts to open, the current starts to reduce, as the change of current always induces a voltage in the inductance proportional to the rate of current change, and the inductance utilizes the energy with which it has been charged, producing a voltage that aids the current. The inductance possesses a high-voltage supplying energy to maintain the flow of current at the instant of rupture. This voltage appears at the switch contacts in the form of an arc. Current continues to flow, reducing at the rate necessary to supply induced voltage for maintenance of the current until the decaying period is over. The more rapid this decay the higher the induced voltage, with its boundary set by the amount of voltage needed to maintain the current. Fig. 6 shows the decaying current plotted against time.

As long as the contactor remains closed, energy remains stored in the transformer. When the contactor is opened the rate of current flow diminishes as fast as is allowed by the transformation of magnetic energy into heat. The less the circuit resistance the faster the transformation, the higher the rupturing voltage at the contactor tips, and the greater the induced secondary e.m.f. Since the resistance of the actual welding circuit is very low the primary current decay is very rapid, developing a large change of magnetic flux which in turn induces a heavy current in the secondary or weld.

The electrostatic stored energy system is shown schematically in Fig. 7, where the power supply consists of a high-voltage three-phase full-wave rectifier used in the magnetic stored energy system. First, the capacitor bank is charged at a high d.c. voltage by the action of the thyratrons. The final value of d.c. voltage is determined by an electronic circuit using the popular grid-controlled thyratron's inherent cut-off characteristic. The material to be welded having been placed between the electrodes and heavy pressure applied to the capacitor, energy is discharged into the welding transformers by means of the electronic switching device. The resulting weld current is adjustable as to crest, rate of rise and time duration.

The electrostatic energy process is based on the ability of a capacitor to receive and store energy in electrostatic form. Here again the welder operates



Welding of an aluminum alloy aircraft part is done on an electromagnetic stored energy machine

from an a.c. source with the a.c. rectified by a multiphase rectifier. The rectifier supplies the d.c. voltage and the charge on the capacitor is proportional to the terminal voltage.

The stored energy is released into a welding transformer and the current assumes the shape shown in Fig. 8. If the resistance is less than the critical value of $2\sqrt{\frac{L}{C}}$ the discharge or welding current will tend to oscillate (Fig. 9). Since adequate energy must be supplied in a very short time to make a good weld and the welding current must die out rapidly to prevent tip arcing on separation of the electrodes an aperiodic secondary current should be best. However, experiments have shown that with certain thicknesses of weld material, good welds are obtained, even if the secondary current is oscillatory. One welding manufacturer, to prevent unwanted oscillations for a given weld, allows the back voltage developed to appear on the multiphase rectifier tubes forcing them to re-ionize absorbing the energy. This back action tends to broaden the current wave (Fig. 10). It is also possible to change the shape of the peak by changing the capacitance value or the ratio of the welding transformer (Figs. 11 and 12). Experiments have shown this to be a desirable feature and as the field of experimentation grows, wave forms of various shapes will be found to best suit the various welding problems.

In charging a capacitor it is necessary to do work to carry the electricity from one terminal of the capacitor to the other. At the start the two terminals are at the same potential. As the charge increases the difference in potential increases. In Fig. 13 at the instant of closing the switch there will be a surge of current or a full value of current to the E/R of the circuit and the current will diminish exponentially as the charge accumulates on the capacitor.

Weld Is Cold Worked

The d.c. power needed for the accumulation of the capacitor or welding energy is obtained from a three-phase full-wave rectifier capable of charging a bank of capacitors totaling 2,640 micro-farads to a voltage of 3,000 volts in $1\frac{1}{4}$ seconds with the kva. demand kept to an approximate 60 kva. rating.

Because the welding current produced by the stored energy methods are high in value and are almost instantaneous, they make quality spot welds possible in a much shorter time interval than the ordinary spot welder. For this reason, they especially adapt themselves to the welding of those metals and alloys which have high thermal conductivities, because the required fusion heat is produced with a completion of the weld before the materials being welded have any chance to conduct the heat away.

By their unique electrode pressure variations during the welding operation, the actual fused portion of the two materials is in effect given a readjustment of grain structure. The pressure variation during welding actually cold works the weld, thus the physical properties lost by the metals under the intense heat of fusion are regained. This assures uniform physical properties of the spots over a given quantity of welds.

The a.c. power demand characteristics of these machines are significantly different from those of the ordinary a.c. spot welder. By storing energy slowly, discharging it quickly, the power peak demand is cut to one-fourth of that required by the conventional a.c. spot welder. Not only is power factor considerably improved but these systems use three-phase power instead of single-phase. This sometimes saves plant engineers many worries, and some plants quite a financial outlay because no auxiliary phase load-balancing is required.

POWER USED BY CONVENTIONAL AND STORED ENERGY SYSTEMS

	A.C. Welder	Stored Energy	
Single Sheet Thickness	Single Phase Kva. Demand	Three Phase Kva. Demand	Spots Per Minute
0.020	80	20	100
0.040	110	25	100
0.060	200	50	70
0.080	000	75	50
0.125	400	90	25

Influence of Temperature on Lathes

BY DR. GEORGE SCHLESINGER, INSTITUTION OF PRODUCTION ENGINEERS, LONDON, ENGLAND

Compensation for misalignments brought about by changes in the temperature of machine elements is essential when the parts must be finished to close tolerances

THE WORKING ACCURACY of both horizontal and vertical turret lathes depends on the alignment of the axis of the work spindle with the tool holes in the turret head. Every user of turret lathes knows that he must be careful in the morning until his machine has warmed up, to avoid producing scrap pieces. Once the job is well started, the machine is generally kept in the warmed-up condition for the rest of the day. Comparison between the ordinary engine lathe and the capstan or turret lathe shows that with the former there is not the same definite relation between the position of the tools and the position of the main spindle either for chucking work or work done between centers. When doing chucking work in an engine lathe, any rise of the spindle can easily be compensated for by adjusting the tools on the slide. In the case of work between centers, even a large vertical deviation of as much as 0.004 in. of the main spindle compared with the tailstock gives only a small deviation from the true cylindrical form.

If in the case of high-speed machines or machines having wide speed ranges, the bearing clearances give trouble when producing precision parts, the alignment tests should be made on the spindles after they have been run for about one hour. If necessary, any adjustments of bearings or guides should be made during the setting up of the machine.

The working accuracy of a good turret lathe is close. Such a lathe must turn round within 0.0004 in. with the turret head slide and the cutting off slide, and turn cylindrically with the turret head slide within 0.001 in. per foot. Errors in facing with the turret head slide are limited to 0.0008 in. per foot and the same accuracy is required from the cutting off slide. There is no doubt that for the extremely rigid vertical boring mills turning up to 32 in. diameter at least the working accuracy of the horizontal turret lathe is attained.

If the headstock and the main spindle warm up during the course of the day, while the turret head with the tools and the bed remain cold, there are differences horizontally and vertically which may have a decisive influence on the accuracy of all pieces which leave the turret lathe in the finished state. In particular, the position of the axis of the last non-floating finishing reamer in the cold stationary turret is considerably changed with regard to a piece held either in the spring collet or jaw chuck due to the tendency of the main spindle to rise. These deviations on warming up have been investigated on a well-designed and well-made capstan lathe with the following results:

The test for horizontal deviation began at 3:45 p.m. The machine was cold and the thermometer, which had been put into an existing deep hole (filled with oil) in the headstock, showed the temperature of the room and headstock to be equal at 13.5 C. The dial gage on the nose of the main spindle had an accuracy of 0.0001 in. per division and showed + 0.0002 in. The whole range of the six speeds was: 71, 131, 241, 453, 834, and 1,531 r.p.m. The machine was started and run idle at 131 r.p.m. After 15 min., during which time the speed was increased each 5 min., the temperature was 20 C. and the indicator showed + 0.0004 in. at 834 r.p.m. At 4:18 p.m., the readings were: temperature, 25 C.; indicator, + 0.0006 in.; speed, 1,531 r.p.m. And at 4:40 p.m. they were: temperature, 30 C.; indicator, + 0.0007 in.; speed, 1,531 r.p.m. This was about an hour after starting. The total horizontal deviation was 0.0007 — 0.0002 = 0.0005

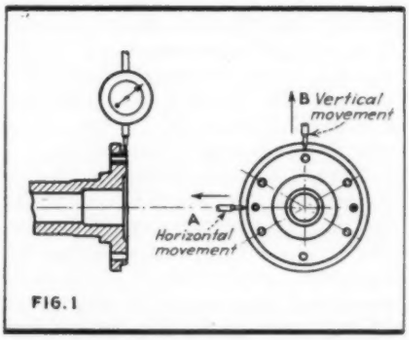


Fig. 1—Arrangement of dial gages for measurement of spindle movement during warming-up tests. Gage *A* measures horizontal movement, while gage *B* measures vertical movement. Each dial gage used for these tests had an accuracy of 0.0001 in. per division

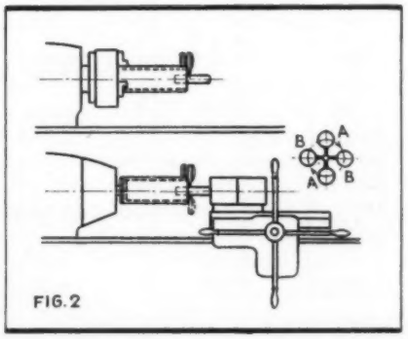


Fig. 2—Method of mounting dial indicator for testing the alignment of tool holes in turret faces by turnaround method. The gage is placed at positions *A* to check alignment with the spindle in a vertical plane and at *B* to check alignment in a horizontal plane

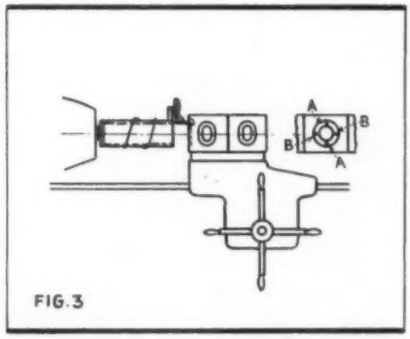
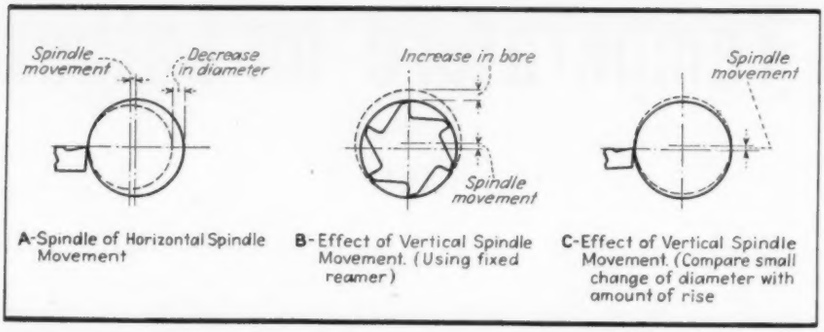


Fig. 3—Method of mounting dial indictor for testing the alignment of recesses in turret faces by turnaround method. The gage is placed at positions *A* to check alignment with the spindle in a vertical plane and at *B* to check alignment in a horizontal plane



A-Spindle of Horizontal Spindle Movement

B-Effect of Vertical Spindle Movement. (Using fixed reamer)

C-Effect of Vertical Spindle Movement. (Compare small change of diameter with amount of rise

Fig. 4—The above sketches indicate the effect of horizontal and vertical spindle movement when using fixed tools on a lathe. The operator must compensate for these movements until the machine has warmed up

HORIZONTAL MOVEMENT OF SPINDLE DUE TO WARMING UP

Time First Day	Dial Indicator Readings	Pre-tension	R.P.M. of Spindle	Temperature: Degrees Centigrade
3:45 p.m.	+0.0002	¾	131	13.5
3:50 "	+0.0002	—	241	14.5
3:55 "	+0.00025	—	453	16.5
4:00 "	+0.0004	—	834	20.0
4:05 "	+0.0004	—	1,531	21
4:18 "	+0.0006	—	1,531	25
4:40 "	+0.0007	—	1,531	30
Interruption — 50-min. standstill				
5:30 p.m.	+0.0007	¾	1,531	26.5
5:50 "	+0.0008	—	1,531	32.1
Second day — Machine was running whole forenoon				
4:15 p.m.	+0.0009	¾	1,531	24
4:55 "	+0.0012	—	1,531	32
5:15 "	+0.0012	—	1,531	35

VERTICAL MOVEMENT OF SPINDLE DUE TO WARMING UP

Time First Day	Dial Indicator Reading	Pre-tension	R.P.M. of Spindle	Temperature: Degrees Centigrade	Remarks
9:40 a.m.	−0.0002	¾	71	14.2	Cold
9:48 "	0	—	131	16	
9:58 "	0	—	241	17.5	
10:03 "	+0.0004	—	453	18.8	
10:10 "	+0.0005	—	834	20.5	First Hour
10:15 "	+0.0007	—	1,531	22	
10:30 "	+0.0014	—	1,531	25	
10:45 "	+0.0020	—	1,531	30	
11:00 "	+0.0022	—	1,531	32	
11:15 "	+0.0022	—	1,531	34	
11:30 "	+0.0023	—	1,531	35.8	Second Hour
11:45 "	+0.0024	—	1.531	37.5	
12:00 "	+0.0024	—	1,531	38.7	
12:15 "	+0.0025	—	1,531	39.6	
Quick Starting (second day)					
9:52 a.m	+0.0001	¾	0	11	Cold
10:00 "	+0.0001	—	71	11	
10:01 "	+0.0001	—	131/241	11.2	Slow speed
10:05 "	+0.0001	—	453	12.1	
10:10 "	+0.0002	—	453	15.5	
10:12 "	+0.00025	—	834	16.2	Fast speed
10:15 "	+0.0004	—	1,531	17.2	
10:22 "	+0.0011	—	1,531	19.1	
10:45 "	+0.0017	—	1,531	26.0	
10:52 "	+0.00175	—	1,531	27.5	

in.; which is just the permissible tolerance for a sliding fit for a piece 1½ in. in diameter. Now the machine was stopped intentionally. After 50 min. stand-still the temperature had decreased from 30 to 26.5 C. without influencing the horizontal position of the spindle. Then the spindle was run another 25 min. until 5:55 p.m. with the maximum speed of 1,531 r.p.m., raising the temperature to 32.1 C. and causing an increase of the horizontal deviation of 0.0001 in. This is negligible for this time, but not in relation to the initial reading. Here the total difference of 0.0006 in. indication is not permissible for many transition fits and some interference fits, and dangerous for tight running fits as fixed by the B.S.I. Standards No. 164.

Thus it is evident that after an hour's initial running, the machine was so well warmed up that the horizontal deviation remained substantially unchanged for the balance of the working day. All tools which work from the horizontal position against the piece externally would, if set when the machine was cold, produce undersize pieces because the tool in the same position as the dial gage would remain stationary while the piece was moving against the tool.

The tests were continued in the afternoon of the next day, but the machine had been run in the morning, loaded by a Prony brake, and remained warm after stopping at 12:15 p.m., when its temperature was 39.6 C. The machine was restarted and run idle at 4:15 p.m. after four hours standstill, at the maximum speed of 1,531 r.p.m. The temperature rose in one hour from 24 to 35 C. and the indicator moved 0.0003 in.; which in many cases can be considered negligible. As a result it can be stated that a long standstill of the warmed-up machine does influence the horizontal expansion, but only by a negligible amount as far as the accuracy of pieces manufactured after the first hour is concerned. The total horizontal deviation of 0.001 in., however, is by no means permissible.

Next, the vertical change due to temperature rise, which has a decisive influence on the accuracy of the machine, was investigated. During the first hour, from 9:40 to 10:45 a.m., the speed was changed in steps from 71 to 1,531 r.p.m. and the machine was loaded up to 2 hp. The temperature increased from 14.2 to 30 C. and the spindle rose from −2 to +20 divisions of the indicator, or 0.0022 in. Using a rigidly held reamer, the bore would have 2 × 0.0022 in. = 0.0044 in. error, which is six times more than the permissible tolerance for a 1½-in. diameter bore made to ac-

curacy B and three times more than that for accuracy U. [The B.S.I. tolerance standard limits are: +0.0007 in., for most accurate holes (B); +0.0014 in., commonly used accuracy (U); and +0.0028 in., larger tolerances (V)].

After the first hour, the temperature rose slowly and the deviation remained within permissible limits. This shows that after the first hour the operator can work undisturbed by the changes of the warmed up headstock in both directions. This is an important result. The workman must know during the first hour that the machine spindle is moving up, and the tool setter has to arrange the tools in such a way that the vertical change does no harm.

It may occur that early in the morning urgent work is required from the machine, with high speeds, and there is no time to wait for an hour before quantity production may be started without danger of producing scrap. The lower section of the table showing results of tests for vertical deviation indicates the result of a quick starting of the machine. The cold machine (11 C.) was run up from standstill to 1,531 r.p.m. (idling) in 23 min. (9:52 to 10:15 a.m.). The temperature rose from 11 to 17.2 C. and moved the spindle upward 0.0003 in. This would have been negligible, but the influence of warming up increased the deviation in the next 37 min. (from 10:15 to 10:52 a.m.) another 0.00165 in., which was already far too much, and was still further increased in another hour, when the temperature rose to 40 C. and deviation reached +0.0027 in. for the rigid reamer. This means 2 × 0.0027 in. = 0.00545 in. increase of the bore, and the production of scrap.

The vertical rise of the spindle makes manufacturing in quantities dangerous for the first hour at least. The operator must have instructions to pay great attention to all tools which work in the vertical plane, both externally and internally. The tool setter can nullify the bad vertical influence of the unavoidable and irresistible warming up by setting and adjusting all external tools in the horizontal plane so that the vertical movement is following tangentially and does negligible harm.

Regarding the bores, however, such an expedient does not exist for multiple-point tools such as twist drills, countersinking bits and rigid reamers which double the error of the eccentric position. For external cutting tools the influence is negligible if they are correctly set up and, further, they can be adjusted easily. For the finishing reamer there is no other means than to make it floating. It then becomes a self-adjusting tool which moves up with the changed position of the main spindle. The tool holes in the turrets of horizontal and vertical turret lathes ought not to be bored until the machine has run at least an hour (better 2 hr. for big machines), and so that the main spindle is in the working position of the warmed up machine; if the holes of the turret head are then bored and reamed, they are aligned for the working machine and for quantity production. The results from an alignment test made on the test machine show clearly that this had been done. The axes of all the turret holes averaged 0.00279 in. higher than the spindle axis when the machine was cold, and this was compensated for by the spindle rise of 0.0027 in., leaving only an error of approximately 0.00009 in. Similarly, warming up reduced the average horizontal "cold" error from 0.00122 in. to approx 0.0004 in.

The objection that for the first hour the tools of the cold machine are in a higher position than for the other working hours of the day is not so important, because an operator has to wait at least a half hour before he begins real manufacturing. After this first half hour, the machine is warmed up sufficiently to avoid scrap—particularly if in this half hour the workman does rough turning and boring. Twist-drills have 0.01 to 0.02 in. allowance, and in performing all the roughing operations the warming up is accelerated. There is no remedy by changing the design, because the influence of heat and the extension of the heated components are inevitable. Their effects can be reduced by the methods outlined above.

MEASUREMENTS TAKEN FROM ALIGNMENT TESTS

(*All Measurements in Inches*)

Test	Permissible Error		Actual Error	Remarks
	Acceptance Test Charts	American		
Centering spindle nose for true running.	0.0004	0.0005 *0.0004	(a) 0.00025 (b) 0.0001 (c) 0.0002 (d) 0.0000 (e) 0.0001 (f) 0.0001	
Tool holes aligned with work spindle in vertical plane. (Tool hole axes higher than axis of cold spindle). (Gage at *A* in Fig. 2)	0.0008 high only. (warmed-up machine)	0.001 high only	Holes No. (1) 0.00285 (2) 0.0028 (3) 0.00273 (4) 0.00282 (5) 0.00276 (6) 0.00274 Average: 0.00279 in. high	Measurements were made in *cold* state! Warming up raised the spindle 0.0027 in. thus compensating for error and reducing it to approximately +0.00009 in.
Tool holes aligned with work spindle in horizontal plane. (Gage at *B* in Fig. 2)	0.0008 either way	0.001 either way	Holes No. (1) 0.00125 (2) 0.00127 (3) 0.00111 (4) 0.00126 (5) 0.00124 (6) 0.00120 Average: 0.00122	Away from operator. Warming up compensated for 0 0010 in., reducing error to 0.00022 in.
Centering recesses aligned with work spindle in vertical plane. (Gage at *A* in Fig. 3)	0.0008 high only	0.001 high only	Holes No. (1) 0.00272 (2) 0.00262 (3) 0.00266 (4) 0.00263 (5) 0.00260 (6) 0.00262 Average: 0.00264	Upwards. Compensated for by warming up, reducing error to approximately 0.00006 in.
Centering recesses aligned with work spindle in horizontal plane. (Gage at *B* in Fig. 3)	0.0008 either way	0.001 either way	Holes No. (1) 0.00118 (2) 0.00120 (3) 0.00074 (4) 0.00108 (5) 0.00094 (6) 0.00096 Average: 0.00102	Away from operator. Error reduced to 0.00002 in. by warming up.

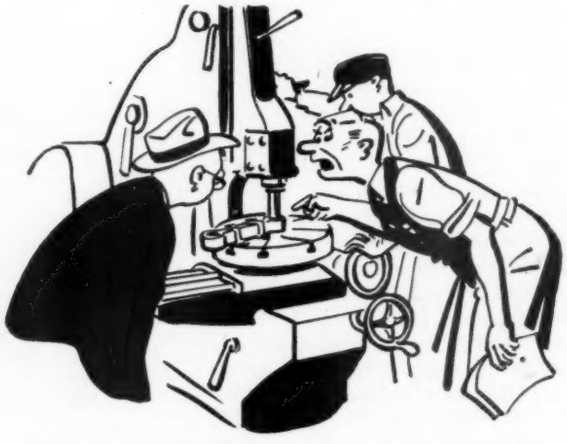
* (B. M. T. E. Sept. Oct. 1938)

How to Convert

BY JOHN HAYDOCK, MANAGING EDITOR, AMERICAN MACHINIST

WE ARE in the midst of the greatest plant conversion in history. Manufacturers of automobiles, adding machines, refrigerators, and many other peacetime products, together with small tool and job shops, are adapting their facilities to wartime production. The training of men, the retooling, the rearrangement of equipment and a score of other steps form a monumental task. Every step requires close consideration and prompt action. If the transition is to be effective, it must be done quickly and well. Anything that will speed conversion will help win the war. Here are a few suggestions that may be of value.

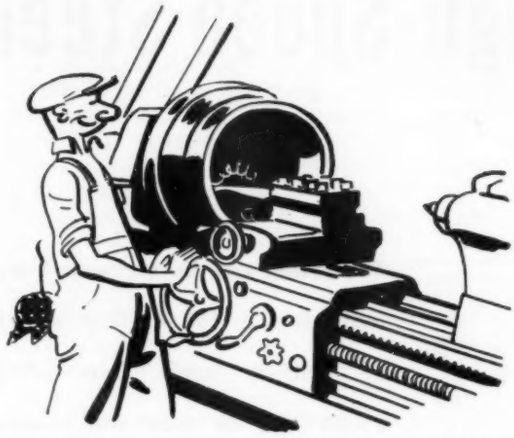
First analyze your product—careful planning, operation by operation, will save time and headaches later



If it's being done by some one else find out how. Visit a government or private plant doing the work

Use equipment you have available if at all possible. New machines take time to get, and time is short

Pay special attention to small tools and gages. You cannot work to close limits unless you can gage them

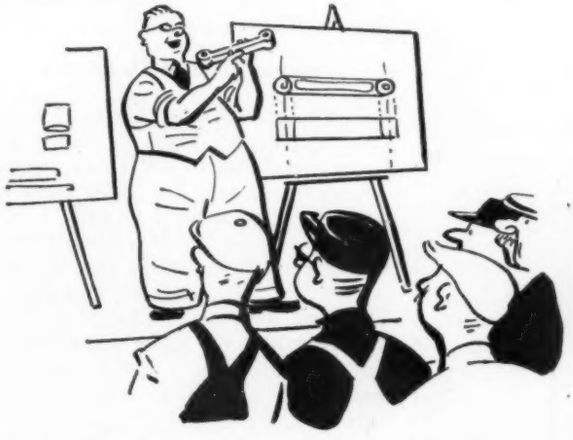


Don't be limited by conventional methods. Maybe a lathe or a drilling machine will serve as a boring mill

Anticipate your needs now. If new machines or small tools are required, act swiftly to avoid costly delays

Throw out surplus equipment. Idle machines must make room for war production. Clear the decks for action

Streamline your paper work. Foremen and supervisors have enough to do without acting as shop clerks

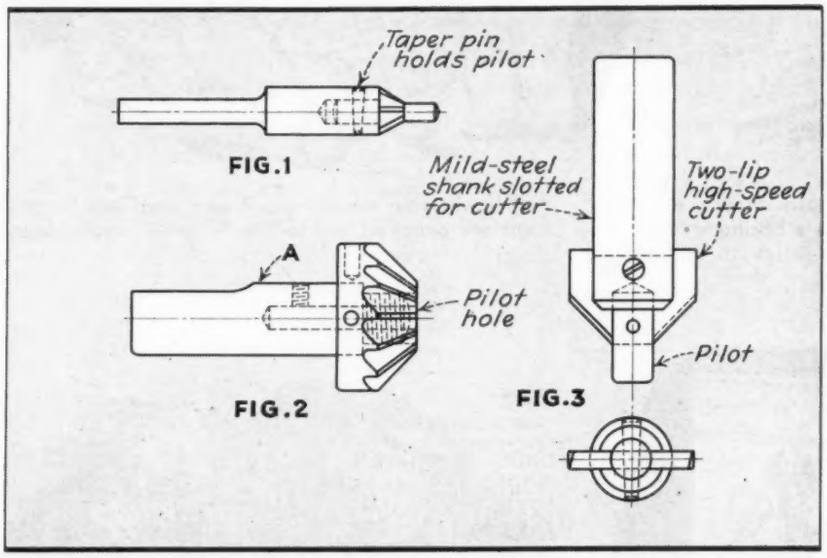


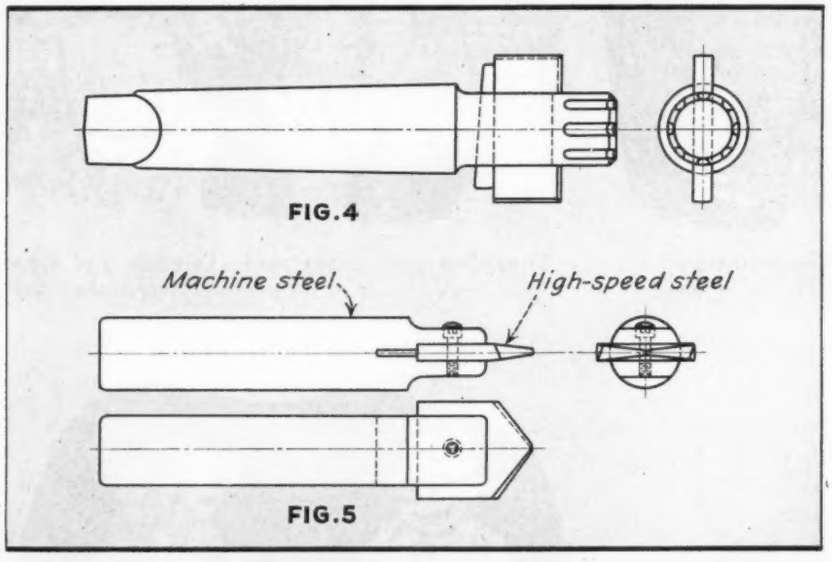
Train your men for war production. Their skill as well as your plant must be changed over to war production

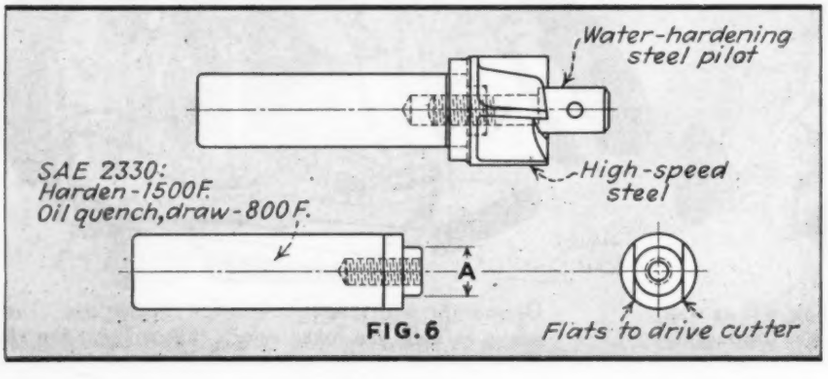
Cooperate with the government inspectors. Their job is to help you make goods that will win the war

Built-Up Tools Save High-Speed Steel

BY PETER L. BUDWITZ, NIGHT SUPERINTENDENT, CUNO ENGINEERING CORP.







Tool steel can be conserved by reserving it for cutting edges of built-up tools. Low-alloy steels can be used for shanks

WITH THE ever increasing difficulty in securing tungsten high-speed steel and tools, shops must make the most of their existing supply and future shipments. Orders for standard cutting tools such as taps, reamers and counterbores are often not delivered promptly; hence, toolrooms may be called upon to make essential tools. There are many examples of how high-speed steel can be employed most economically in the design of the more commonly used tools. Some of these are shown in the accompanying drawings.

Figs. 1, 2 and 3 show countersinks utilizing high-speed cutting tips and mild-steel shanks. The simplicity of the construction used for the countersink in Fig. 2 renders it useful in many combinations. High-speed taps, as well as spot facers, counterbores and combination cutting tools, may be made this way. In making this form of tool care should be taken to bore out the back end of the cutting tool proper so as to fit snugly on the large or unthreaded section of the shank. The component threaded parts should fit comparatively free, thus insuring a truer running tool. A few holes can be drilled around the periphery of the cutting tip for wrench grips to facilitate removal.

Making Tools With Pilots

A taper shank boring bar employing a flat high-speed blade is shown in Fig. 4. An elongated slot is cut through the holder to take the cutter, and a tapered wedge is used to lock it securely. The pilot end of the holder has semicircular flutes milled around the periphery for chip and dirt clearances. This kink is especially effective in machining cast iron. After machining I heat the holders to 1,500 F., quench them in oil, and draw them in a salt bath at 900 F.; the extreme pilot end is not drawn quite as much. This treatment imparted good tortional resisting qualities to the holders.

If a drill of large diameter is needed, the flat type shown in Fig. 5 can be made easily.

The counterbore shown in Fig. 6 can readily be made in the average shop. The back end of the cutter is counterbored and slotted to engage the shank. The counterbored diameter should fit accurately over dimension *A*, thus locating the cutter true with the shank of the tool.

Welding can be employed successfully for the economical use of material. Savings can be affected by making spot facers and counterbores as shown in Fig. 7. A two-diameter assembly pin is made to enable the welder to locate the shank and cutter symmetrical. In hardening welded tools, preheating is of prime importance. Heat then to 1,200 F. and transfer them to a furnace maintained at 1,600 F. When the tool has reached this temperature it is placed in the high-heat chamber at 2,300 F. After quenching, tempering should follow at 1,050 F.

Designs Can Be Altered

In almost all shops there is a need for the long slender piloted countersinks shown in Fig. 8. In an effort to conserve high-speed steel the design was altered from the solid style in Fig. 8 at *A*, to the type shown in Fig. 8 at *B*.

An easily built spot facer is shown in Fig. 9. As the cutter wears, washers can be inserted between it and pilot shoulder to keep the dowel pin tight against the semicircular slot in the cutter.

Homemade tools will fail in service unless careful attention is paid to tooth forms, avoiding sharp corners wherever possible. Periphery clearances should be provided; if proper cutters are not available for milling the clearance, a reasonable job can be done with a file.

Fig. 10 shows some constructional suggestions which will aid in overcoming unnecessary and costly tool failures. Good and bad tooth forms for counterbores or spot facers are shown at *A*. At *B* is shown an excellent tooth form for counterbores of large size; cutting edges milled ahead of the radial center line aid in keeping chips from crowding around the pilot. Small semicircular grooves cut in the teeth in staggered positions contribute toward freer cutting action by breaking up the chips. The proper method of undercutting for grinding of diameters on combination tools is indicated at *C*.

For deep-hole counterboring it is a good policy to taper the back end of the tool as shown at *D*. This will minimize breakage due to seizing. A good tooth form for large counterbores can be produced by first using a radius cutter then finishing with a plain milling cutter as shown by the dotted lines at *E*.

The practice of trying to harden high-speed steel without the use of a pyrometer to measure temperature should be entirely discouraged. For general purpose tools 2,300 to 2,350 F. are good hardening temperatures. High-speed tools should be preheated prior to placing them into high-temperature chambers. I have used 1,050 and 450 F. as drawing temperatures. For tools that were quenched in the range of 2,250 to 2,400 F. they were drawn at 1,050 F. at least an hour, depending on tool size. Good results were obtained on certain tools, especially those of smaller sizes, when quenched at 2,200 F. and drawn at 450 F.

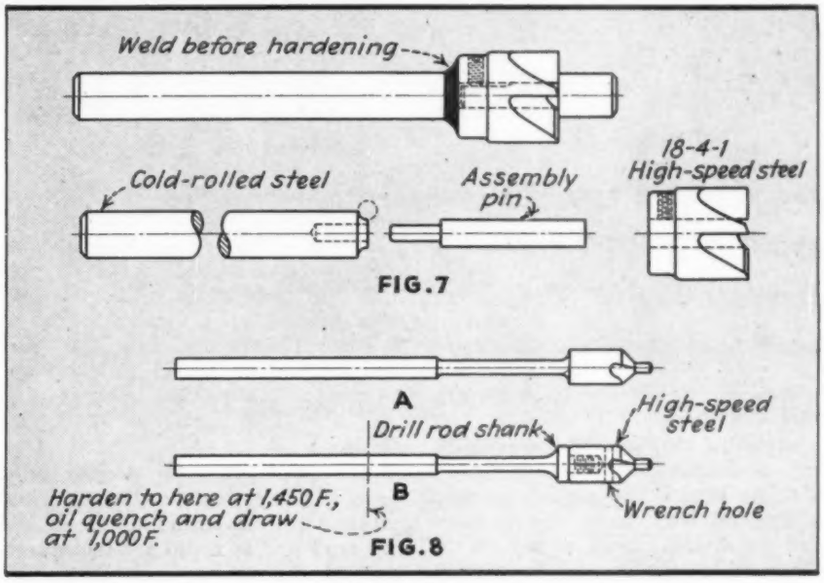


FIG. 7

FIG. 8

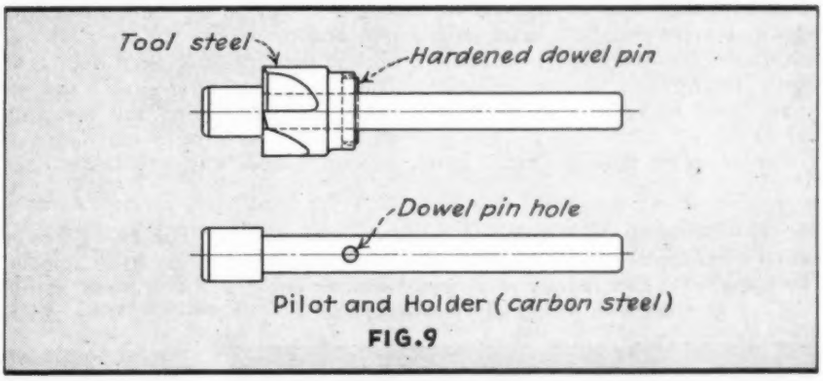


FIG. 9

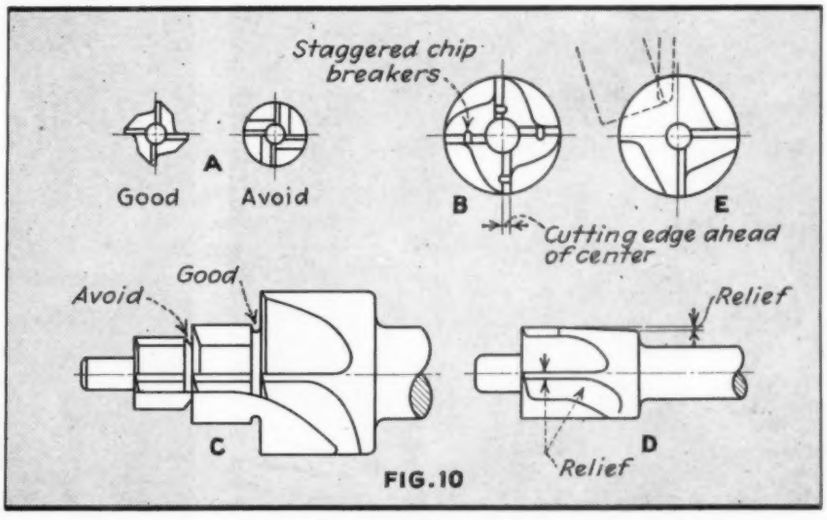


FIG. 10

METHODS OF CAM MILLING—2

Use of the Dividing Head

BY H. A. FROMMELT, DIRECTOR OF INDUSTRIAL RESEARCH, KEARNEY & TRECKER CORPORATION

The variety of cams that can be cut on a milling machine is greatly increased through the addition of a good dividing head

RADIAL OR PLATE CAMS can be machined when only a horizontal or vertical milling machine and a rotary table are available. Assume now that a dividing head is also part of the shop equipment. Then the milling machines and the dividing head, as well as the rotary table, can be used for cutting radial and plate cams of different designs such as the periphery, heart, frog, mushroom, grooved-face, toe-and-wiper, rolling and duplex or yoke types shown in Figs. 1, 4, 8, 9, 10 and 11.

The set-up for milling a radial cam using a horizontal milling machine and a dividing head is shown in Fig. 12. Here, as when the rotary table is used, the cam must first be laid out and transferred to the blank with aid of a templet when accuracy is not a prime consideration. Otherwise the layout should be carefully made directly on the blank using the dividing head and other instruments to locate the outline.

The blank must be divided into equal angles as shown in Fig. 13. This provides the movements of the dividing head just as it did for the operation of the rotary table. With the outline scribed on the blank it is necessary first to remove the metal down close to the outline between the lobes. This can be done by drilling a row of holes near the outline and breaking off the extra parts, or by roughing out the cam contour with a band saw.

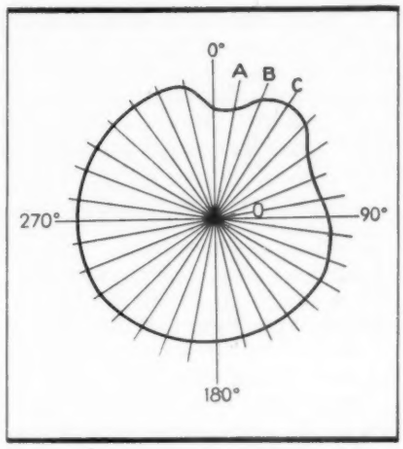


Fig. 13—The cam blank is divided into equal angles to provide settings for the dividing head. The smaller the angles, the less hand filing will be necessary to finish the cam

Fig. 12—Radial or plate cams of many designs can be cut on a horizontal milling machine using a dividing head. The blank is set successively at different centers and the cam cut with passes of the boring tool

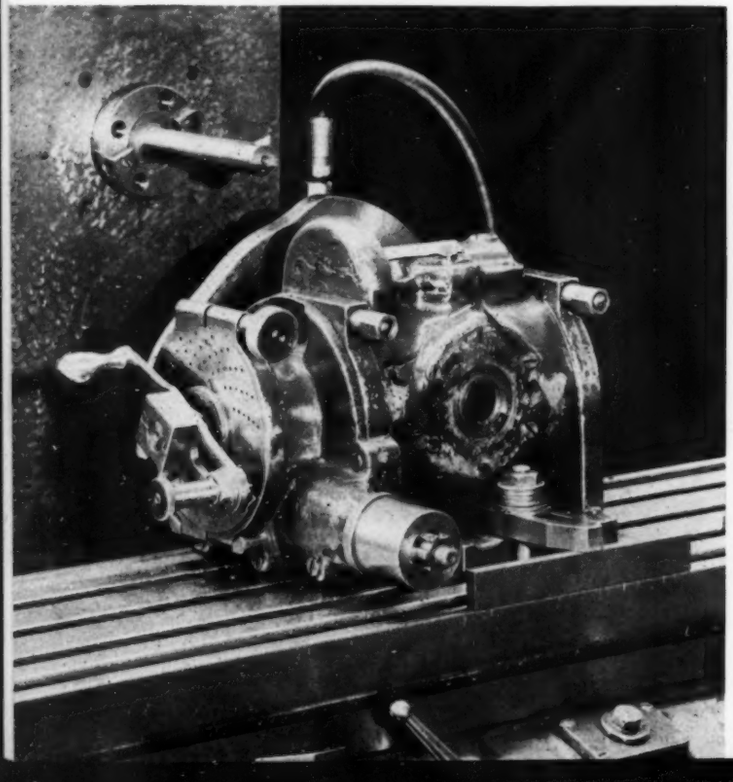
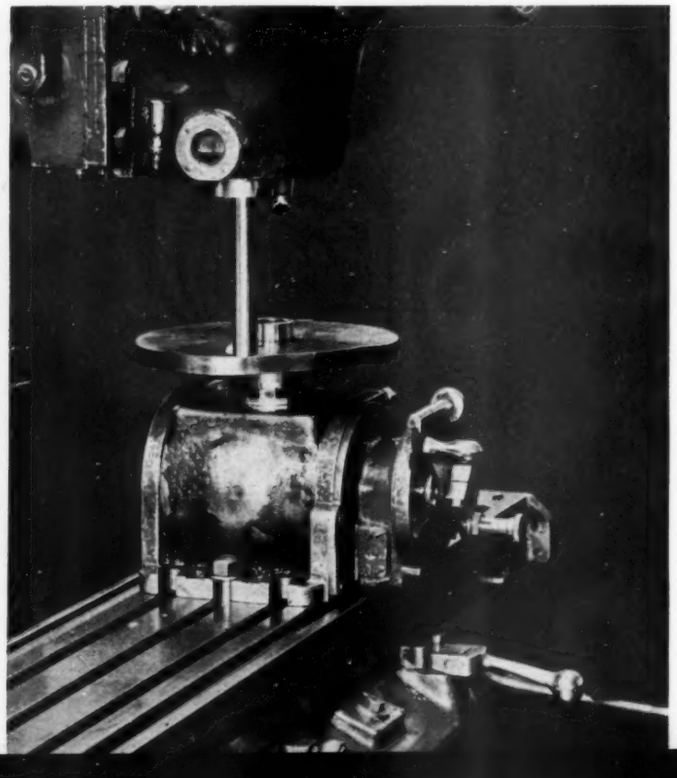


Fig. 14—When using a vertical milling machine, the dividing head spindle is set vertical bringing the cam blank in a plane horizontal to the machine spindle. The radius of the cut must be the same as the cam roller



The roughed out plate is now mounted on an arbor in the dividing head as shown in Fig. 12. The tool is so set in the spindle that its radius is equal to that of the cam roll called for in the actual application. Unless this is accurately provided for the cam will not function as designed. If the diameter of the cut is larger than the cam roll, the rise and fall movements will be less. If smaller, these movements will be larger. Hence the necessity for care in this phase of the operation.

The plate is now machined with passes of the cutter set successively at centers *OA, OB, OC, OD,* etc., shown in Fig. 13. Obviously, the dividing head is used in this method to move the cam blank from the position *OA* to position *OB* and successively to the other centers as laid out on the blank. The cutter is set to the centers as laid out in the blueprint.

The final operation of draw filing the high spots is necessary in this cam milling method in order to remove the tool marks.

Cams Cut on the Vertical Miller

The set-up shown in Fig. 14 demands but a slight change in operation as compared with that presented in Fig. 12. The dividing head spindle is now vertical so as to present the workpiece in a horizontal plane to the spindle in the vertical milling machine.

The cam outline is first laid out accurately on the blank itself or scribed thereon with the aid of a templet. The stations shown in Fig. 13 are again located on the blank and the cam form is ready for roughing out by drilling holes around the periphery or contouring with a band saw. The roughed out blank is now mounted in the dividing head. Again, the cutter is set in the spindle so that its radius is equal to that of the cam roll called for by the design.

The center of the cutter is now made to coincide with the centers shown at *A, B, C,* etc., successively. The angular movements necessary for the positions are effected with the dividing head.

Draw filing must be resorted to as a final step in order to remove the tool marks.

This cam is milled accurately with nothing more than a vertical milling machine and a dividing head. Production time can be reduced by using other equipment and methods as will be explained subsequently; still, it is sometimes necessary and advisable to mill a radial or plate cam by the method just described.

It is interesting to note that a slight variation of the preceding two methods can be introduced by the use of a vertical milling attachment on a horizontal milling machine this combination to be used in conjunction with a universal dividing head.

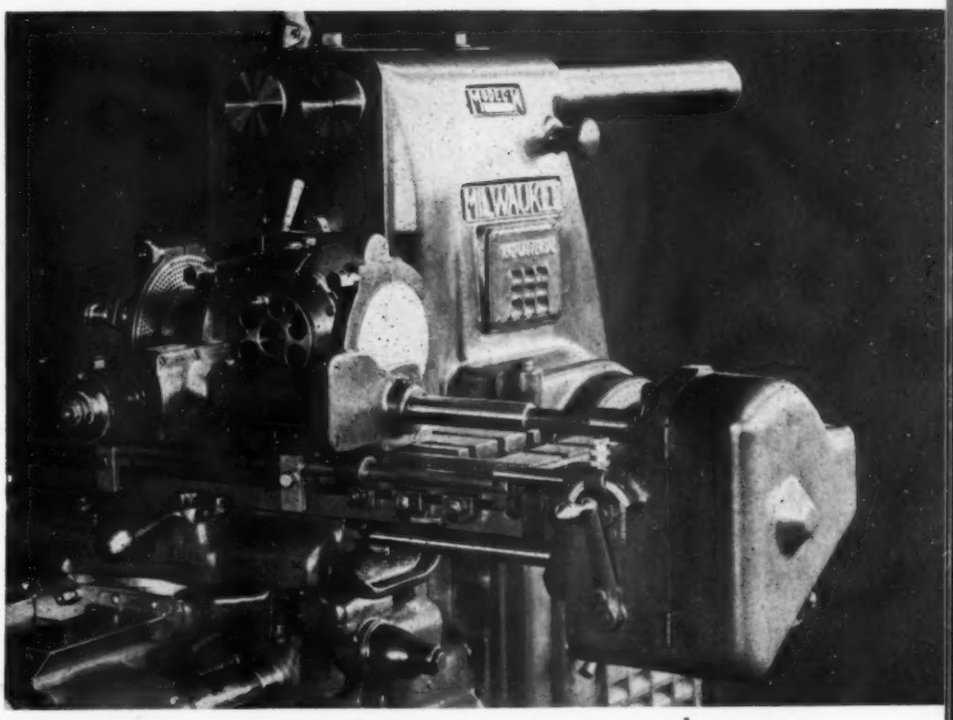


Fig. 15—The methods described for milling radial and plate cams can be used also in conjunction with a right-angle drive bracket that imparts power to the dividing head through the table lead screw

However, this suggested method has more interest than actual use value. Obviously, if a horizontal milling machine and a dividing head are available, the set-up shown in Fig. 12 is most logical. In fact, this arrangement can be used with a plain dividing head. Hence, the addition of a vertical milling attachment to the equipment adds nothing to the flexibility that is so desirable when pressure on shop equipment is increased. But this combination of a horizontal milling machine, a vertical milling attachment and a dividing head indicates the possibilities that can be effected when milling cams.

Dividing Head Can Be Power Driven

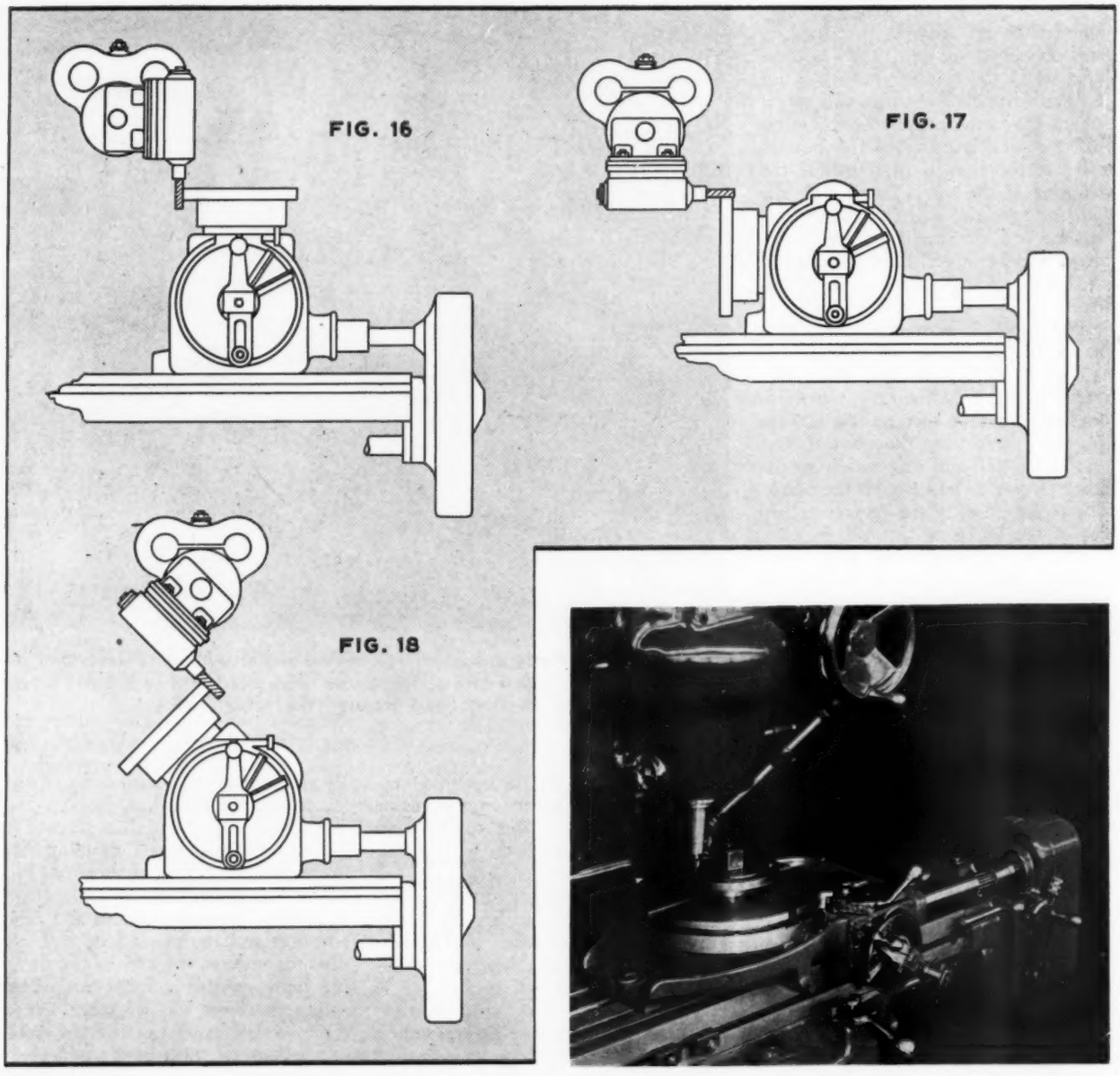
Any of the methods for the milling of cams thus far described can be used in conjunction with a right-angle drive bracket that power drives through the table screw either the dividing head or the rotary table. This set-up is shown in Fig. 15. An end mill is used in the vertical milling attachment, which is set to mill the periphery of the cam at right angles to its sides or, in other words, the axes of the dividing head spindle and attachment spindle must always be parallel to mill cams according to this method.

The explanation of this method is as follows: The universal dividing head is elevated to 90 deg. as shown in Fig. 16, and is geared for any given lead. It is then apparent that as the table advances and the blank is turned, the distance between the axes of the dividing head spindle and the attachment spindle becomes less. In other words, the cut becomes deeper and the radius of the cam is shortened producing a spiral lobe, the lead of which is the same as that for which the machine is geared.

Minimizing the Use of Change Gears

The following explanation will make clear why the universal head must be set at some angle greater than zero and not more than 90 deg. Suppose that the same gearing be retained and the spiral head be set at zero, or parallel to the surface of the table, as shown in Fig. 17. It is apparent that the axes of the spindle and the vertical attachment are parallel to one another. Therefore, as the table advances and the blank is turned, the distance between the axes of the dividing head spindle and the attachment spindle remains the same. As a result the periphery blank, if milled, is concentric, or the lead is zero.

But if the spiral head is elevated to



When using power-driven dividing heads, the axes of the dividing head spindle and milling attachment spindle must be parallel as in Fig. 16, or at an angle as in Fig. 18. If the spindles are at right angles, as in Fig. 17, the cam blank when milled will be concentric. Fig. 19—A rotary table driven through the table lead screw can be used to mill spiral or concentric grooves in a cam plate bolted horizontally on the table.

any angle greater than zero, as in Fig. 18, the amount of lead given to the cam will be between that for which the machine is geared and zero. Hence it is obvious that cams with a large range of different leads can be obtained with one set of change gears, and the problem of milling the lobes of cams is reduced to a question of finding the angle at which to set the head to obtain any given lead. And this the milling machine manufacturers provide in tables from which the proper angles and change gears can be selected.

This method of cam milling is advisable whenever the lobes of the radial or plate cam are not so numerous as to make the changing of the lead gearing impractical. In other words, if the rates of change in the rise and fall measurements are somewhat regular and not too numerous, this method of milling such cams is much to be preferred to those previously described. The time-consuming labor of draw filing is eliminated and, if anything, the accuracy obtained when machining the cam is increased.

The blank is laid out in the same manner as previously described. The roughing operations are performed and the blank is then mounted on the dividing head spindle. When the proper gearing has been selected according to the lead of the cam lobes, the milling of operations for the finishing of the cam outline can be completed, using the proper speed and feed.

The set-up shown in Fig. 19, which employs a rotary table driven through the table screw, can be used to mill spiral grooves in a cam plate. Machining principles already given are used.

This is the second of a series of six articles on cam milling. The third will appear in an early number.

Production With Precision

BY GEORGE SCHERR, PRESIDENT, GEORGE SCHERR COMPANY

OUR PRODUCTION SCHEDULE demands 60,000 planes; 45,000 tanks; 20,000 anti-aircraft guns, necessary parts and ammunition to go with them in 1942. American industry is on the job and will produce what is humanly possible.

There is, however, one word of warning which should be sounded at the outset and which must be heeded in all seriousness by those responsible for this enormous mass production. A recent radio broadcast in which WPB Administrator Donald Nelson spoke the concluding sentences dramatized the need for speed. The announcers filled the air with exciting demands for 24-hour continuous work, accompanied by stirring sound effects: whistle blowing, air-hammer riveting, planes droning—it made an impressive radio show.

Was there any word or thought of quality, workmanship or precision? Just once, when Mr. Nelson stated that he had returned from a visit to the proving grounds, and had left convinced of the quality and efficiency of American planes and tanks.

Speed Alone Useless

Speed is not the only factor in our war production, nor is it necessarily the most important. What good would it do us to get 60,000 planes by the end of December if half of them developed mechanical defects caused by improper workmanship, slipshod inspection, inaccurate fits, excessive wear of moving parts due to poor finish and faulty material? Such planes might conceivably be more dangerous to our own men than to the enemy.

High grade alloy steels are needed which must be produced conscientiously to accurate specifications. Pressure for speed and quick delivery must never allow any material of sub-standard quality to reach the manufacturing plants.

More rigid testing of material must be instituted not only at the mills, but also at the receiving department of the plant. With expanding production and the creation of new concerns and factories the need for new laboratories and testing equipment must be given immediate thought. Testing materials and chemical analysis are at the very top of production.

Next in importance is rigid inspection for size, form and finish. Tools, dies, gages, jigs and fixtures of great precision are required. Old time methods of inspection and measuring, depending largely on the individual skill and "feel" of operators, must be supplemented wherever possible with methods which eliminate the human equation, making it possible to use less skilled help. In order to illustrate the importance of rigid inspection take the example of a ball bearing.

If a single ball in a set is 0.0001 in. oversize it will have to bear the load, resulting in breakage of the ball. Picture the great consequences from a little cause if this should happen in the field.

American industry has developed instruments and tools for accurate inspection with inexperienced help. Many of these are low-cost devices which are in the range of the small shop. They make accurate inspection possible in any shop.

The manufacturer of armament requires absolute interchangeability. Work that is produced must interchange with work turned out by other shops that may be located thousands of miles apart. At present this is especially important, since large and small shops all over the nation must cooperate to produce large quantities of individual parts, which ultimately must accurately fit together. Repair parts and spare parts must fit instantly without waste of time for filing or matching them together.

Utmost vigilance and greatest care to obtain quality of production is a paramount issue of the day. Speed is desirable, but overspeeding may be disastrous.

Let's keep our heads and listen to the experienced production engineer who knows what's needed.

IDEAS FROM PRACTICAL MEN

General Purpose Milling Fixture

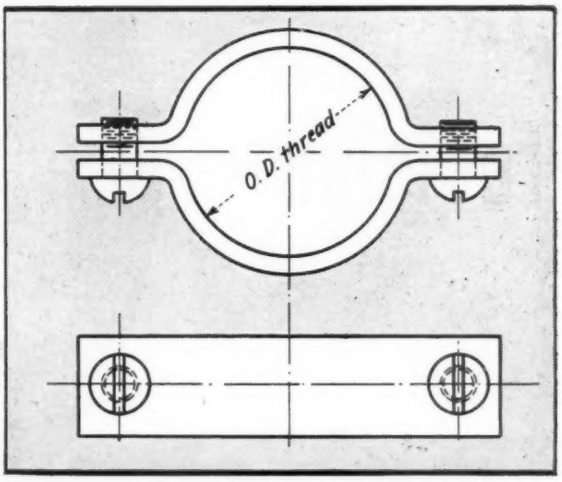
BY FRANK HARTLEY

While many milling fixtures are of a special nature and designed for a particular part, the fixture shown in the drawing is equipped to handle any type of work which can be held in the chucks.

Body *A* of the fixture contains two vertical shafts *B* and *C*. Mounted on the upper ends of these shafts are two chucks *D*. Work held in the chucks is simultaneously milled by two groups of cutters. In addition two parts can be revolvably milled, or the chucks can be used for index milling.

For index milling, locking pins *E* and *F* enter notches in plate *G* on each vertical shaft. Two notches are provided in the construction shown, although four or more could be employed if needed. These locking pins hold the chucks at the desired radial location. To disengage the pins bar *H* is provided with a handgrip *J*. Through the center of bar *H* is rod *K* with spring *L* to hold the locking pins.

To revolve the chucks worm wheel *M* is provided on each vertical shaft which mesh with worms *P* on cross shaft *N*. As the operator turns hand wheel *Q* the chucks and work are revolved. The index pins must be disengaged when starting to revolve the chucks. Either vertical or horizontal milling cutters can be used with this device.

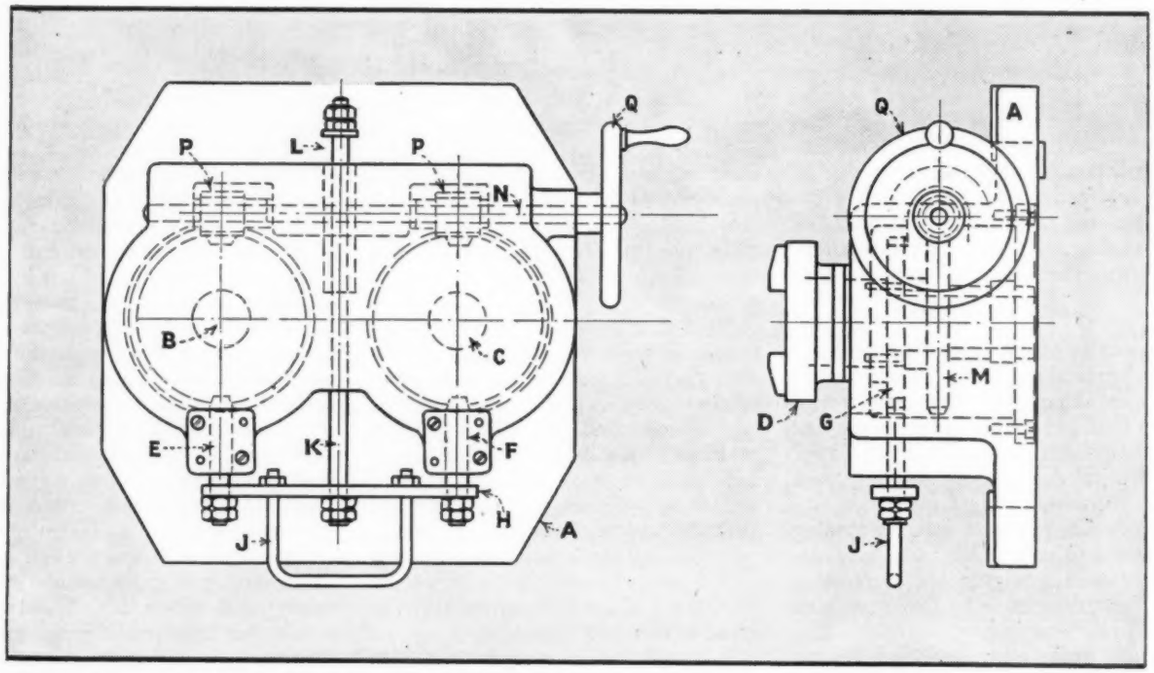


This simple clamp fits around a thread column just above the hose and locks the column in position

Thread-Column Clamp

BY HENRY R. BOWMAN

In the swivel top table for handling heavy dies which was described by John E. Hyler (AM—Vol. 86, page 164) I notice that there is no provision made for locking the threaded column in position.



This milling fixture is equipped with two chucks and can be used for plain, index, or circular milling of parts which can be held in the chucks

Experience with a similar case indicates that the screw will revolve slightly despite the thrust bearing, necessitating frequent readjustment.

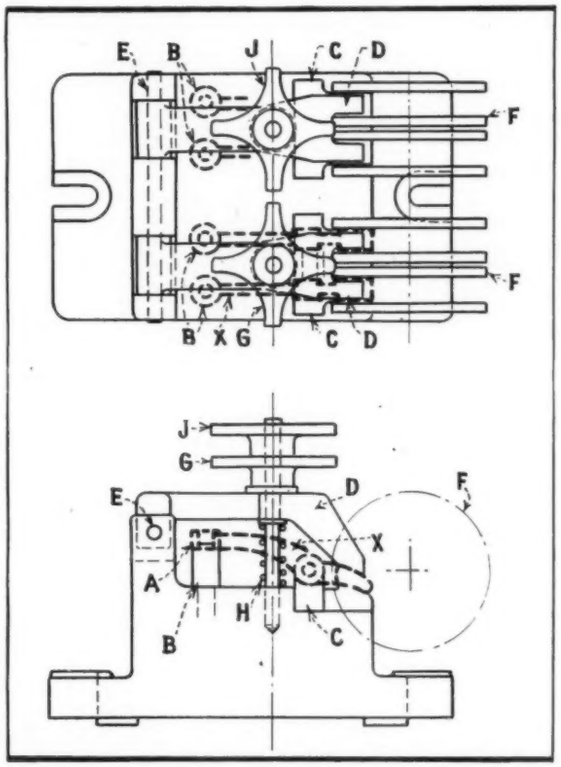
This difficulty can be overcome by making a clamp like that shown in the drawing. The clamp is made in two sections which are held together by cap screws. The sections grip the outside of the thread and rest on the upper edge of the base, holding it at the desired height.

Fixture Permits Multiple Milling

BY F. H. JOHNSON

The production of small milled parts can be increased by the use of dual holding arrangements. One such arrangement is illustrated in which four parts are milled at one time.

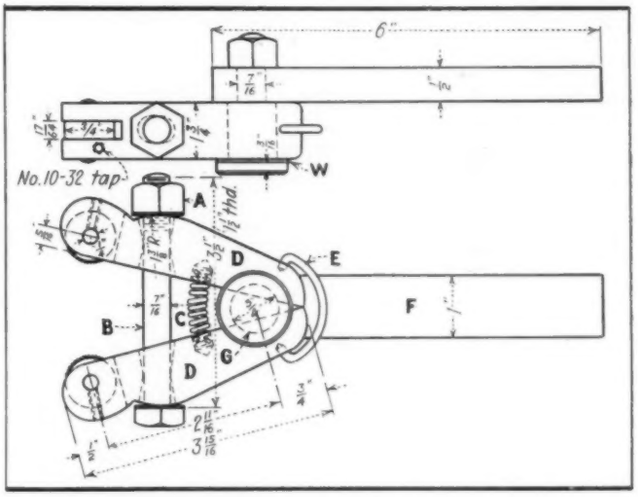
The work is located in the fixture in two ways. Outer end *A* fits over pin *B* and the finished side bosses slip into a groove in block *C*. Two parts are held in place by clamp *D* which is hinged at pin *E*.



Four parts are held in this fixture for milling simultaneously. Two fixtures in an index base permit loading at one end and milling at the other

This clamp is constructed with prongs at its end so that straddle milling cutters *F* can work in the position shown. To place the work, handknob *G* is raised by spring *H* so that the work can be slipped into position from the side. Handknob *G* is then tightened and the parts are secured ready for milling. At the rear of the fixture handknob *J* operates in the same manner to hold two more parts in the proper milling position.

Two complete fixtures can be mounted on a single base. The base should be of the rotating type with an indexing and locking pin arrangement so that the operator can load four parts at one end, while four at the other end are being milled.



Work which can be held in a chuck does not have to be centered for knurling with this tool. The knurls are free to float upward or downward as required

Knurling Tool Eliminates Centering

BY MARTIN H. BALL

Work that is held in a chuck for forming, need not be centered for knurling with the tool shown in the drawing. The tool is located vertically central by the lathe cross feed screw and is free to float upward or downward as may be required. The knurls are brought into contact with the work by tightening nut *A* on adjusting bolt B.

Coil spring *C* is light and serves only to keep knurl holding jaws *D* apart. Retaining spring *E* serves to hold the whole unit together by light friction.

Knurl holding jaws *D* are connected to shank *F* by pin *G* with the spring washer *H* providing enough pressure to prevent the jaws from falling while adjustments are being made.

As there is no side pressure applied to the work, pieces with larger and smaller shanks can be knurled than with a tool which requires the work to be supported by a tail stock center.

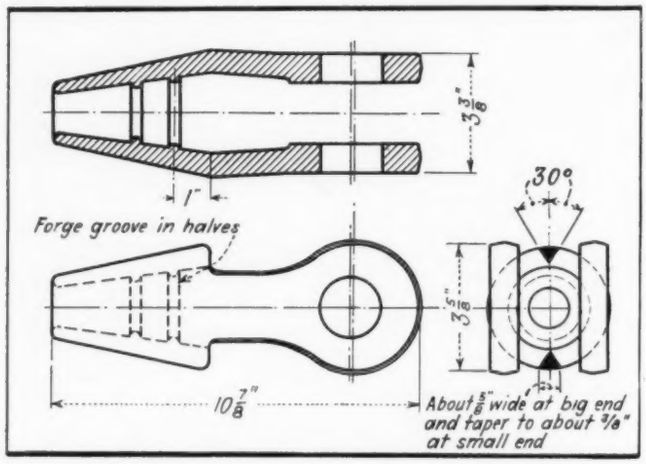
Welding Simplifies Cable Socket Production

BY ROBERT WAGNER

When work began to lag in the weldery and machine shop of the Mississippi Valley Barge Line Company, a supplementary production of cable sockets for wire cable was inaugurated. Formerly, all sockets were forged into one piece. This method

required an expensive die and involved a number of time-taking operations.

In the experimental stages, a $\frac{3}{4}$-in. plate was burned out to the proper shape; drawn out thin on one end in a simple form by a blacksmith; then heated and the cone formed in another simple shape. Two pieces were made exactly alike. Finally, these pieces were beveled and the two halves welded together. This new method permitted the forging of the two rings in



The cost of producing cable sockets has been reduced by forging the socket in halves which are welded together

the cone to prevent the zinc from backing out. Former methods of construction required machining of the solid cone for placement of the zinc. A substantial saving resulted from this change.

This method proved so successful that the company has decided to work a die for forging the halves for speedy production. Then the only remaining operations will be to weld the halves together; touch up the weld on the grinder; and run a drill through the holes. Construction is shown in the drawing, supplied by the Hobart Brothers Company.

Drill Jig for Bomb Fuzes

BY MURRELL KAUTZ

The angular holes in bomb fuze bodies (*AM*—Vol. 85, page 1325) could be drilled at a higher production rate and with less operator fatigue with a modification of the jig used.

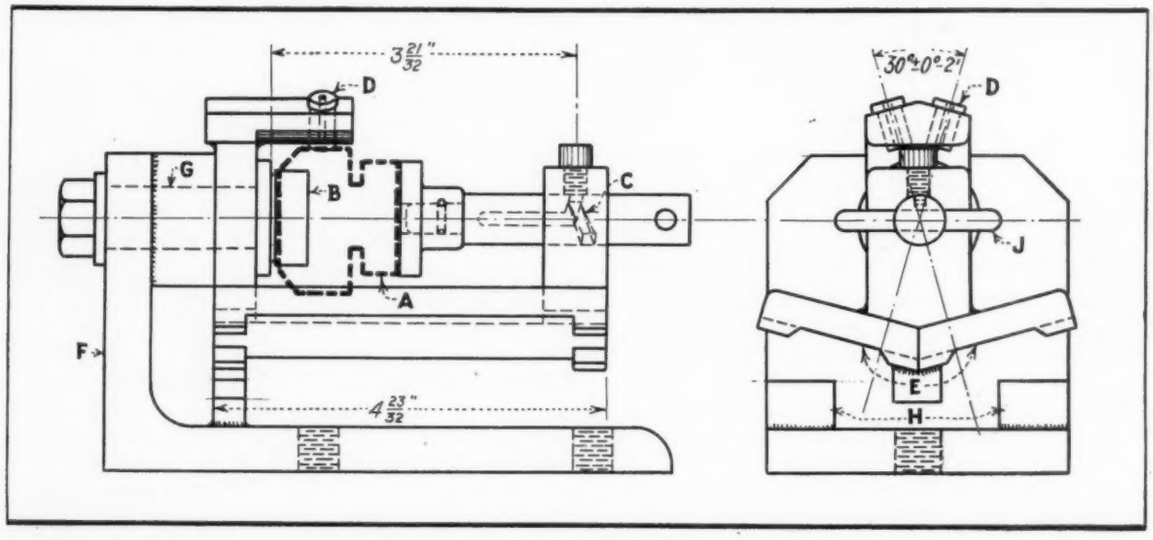
Fuze body *A* is fitted into the jig with the bore locating over hub *B*. Locking cam *C* holds the work in place. Bushings *D* pilot the drill which drills the two angular holes.

The jig is equipped with two bases *E* on which the jig rests successively to bring the two bushings into a vertical position.

Production could be speeded by mounting this jig in a frame *F* so that it was free to swing at *G* on the axis of the fuze body. Stops *H* would be welded to the frame and filed to suit so that the bases of the original jig would come to rest against them when drill bushing *D* was in the proper position for drilling the angular holes.

With this arrangement the jig could be fastened under the drill spindle in the proper position. The operator would locate the bomb fuze body on hub *B*, and lock it in place by turning clamping lever *J* which would actuate cam *C*. He would then swing the jig against one stop and drill the first hole; swing the jig against the other stop and drill the second hole.

The task of slipping the jig into proper position under the spindle for each hole would thus be eliminated and the production rate increased accordingly by this addition to the fixture.



Two angular holes are easily drilled in bomb fuze bodies in this jig which swings against stops to bring the bushings into position under the drill spindle

Armament

SECTION OF AMERICAN MACHINIST

To spot-face and bore at opposite sides of the main center section of the crankcase, a two-way machine is employed

Aircraft Engines by Buick

also Machine Guns from "Task" Operations

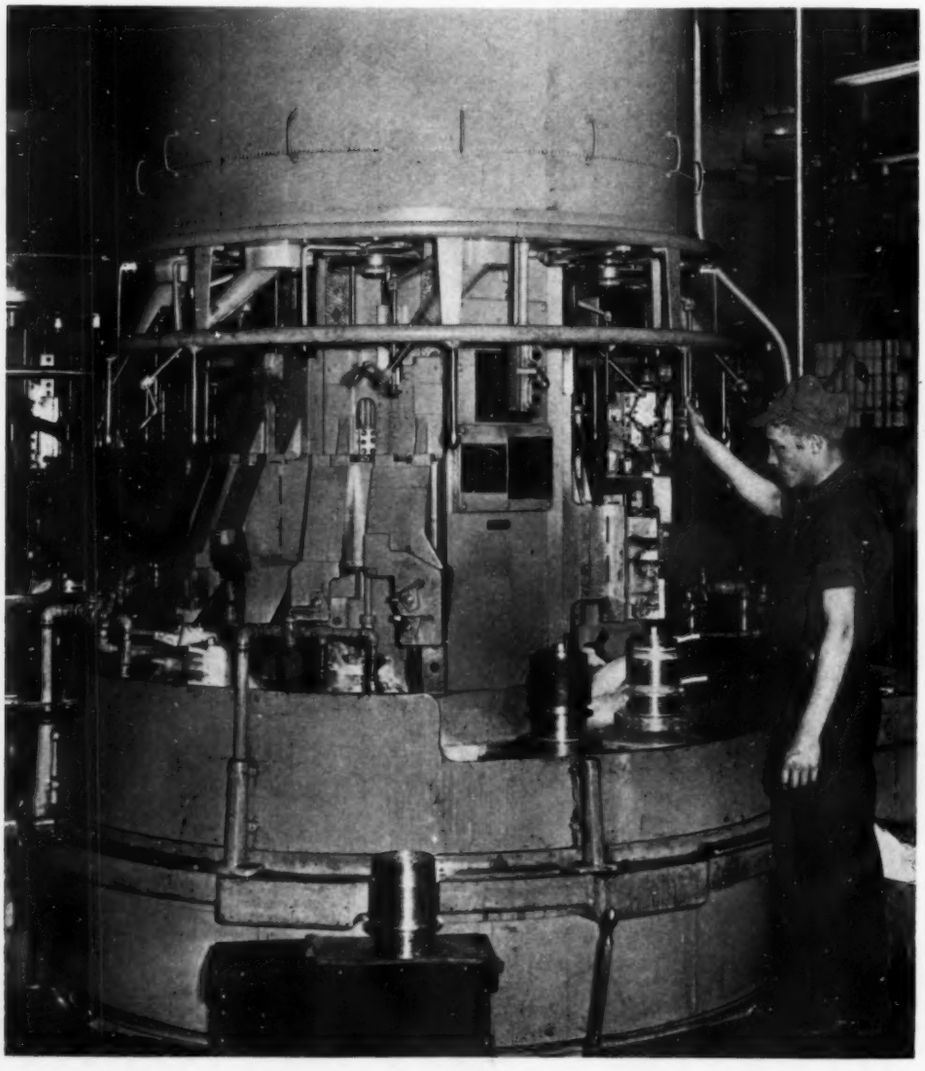
This article has been reviewed and approved by the proper military authorities

AIRCRAFT ENGINES by BUICK

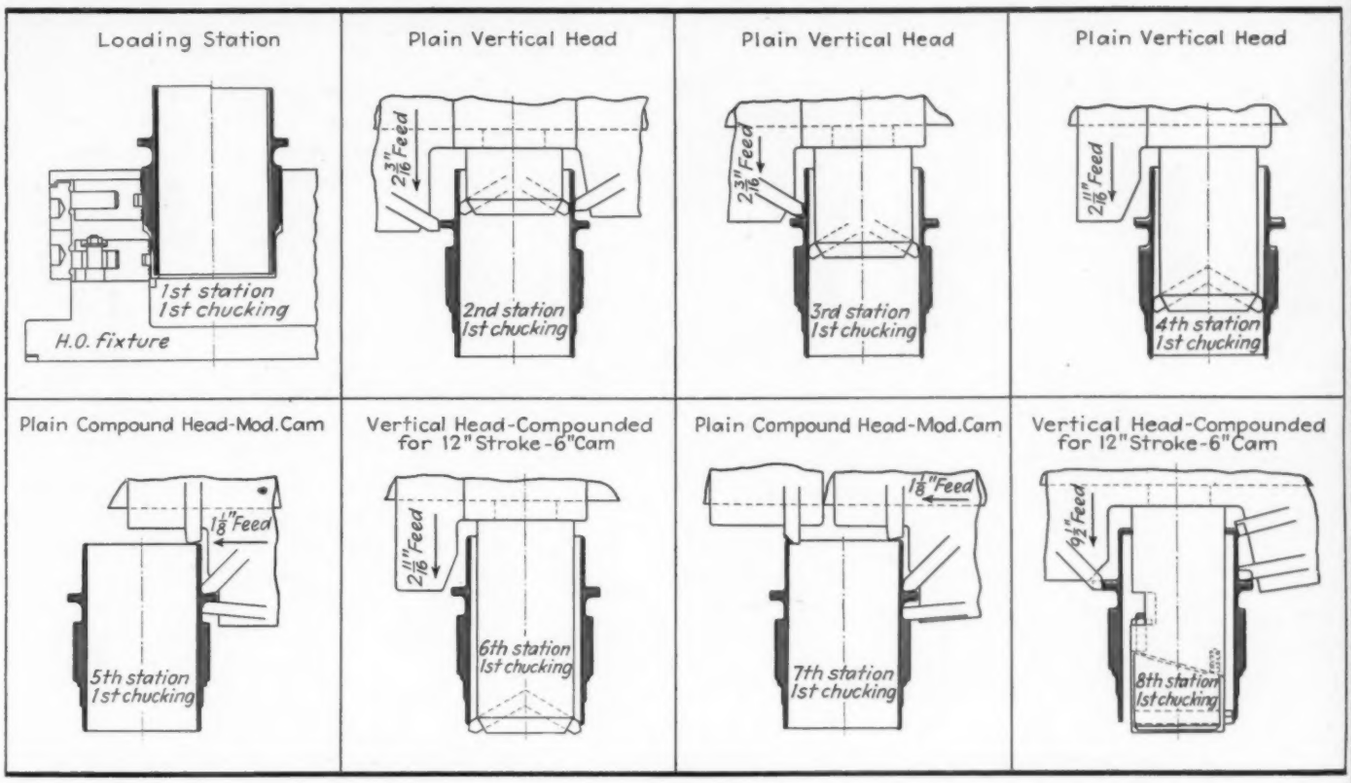
BUICK'S MASTER MECHANICS and tool engineers have applied their automotive experience to the mass production of aircraft engines. Although original monthly quotas did not justify extensive use of single-purpose machines, tooling was selected with an eye to future requirements. Stepped-up schedules since acceptance tests on the first pilot engine, early in January, have accelerated the adoption of methods new in this field. As a result of this foresight, bottlenecks have been avoided, time and floorspace has been saved. Present plans calling for a four-fold increase in output will see the introduction of further novel manufacturing methods.

Buick's application of a large battery of Bullard Mult-Au-Matics to the cylinder barrel, avoided a bottleneck when production quotas were boosted to present levels. Barrel forgings, purchased in the rough-turned condition, have scale removed and flaws detected before receipt. Two further machining operations are required: (1) to rough bore the barrel and rough turn the end above the chuck jaws, and (2) with the part reversed in the chuck of another machine, to finish the bore and rough turn the remainder of the O.D.

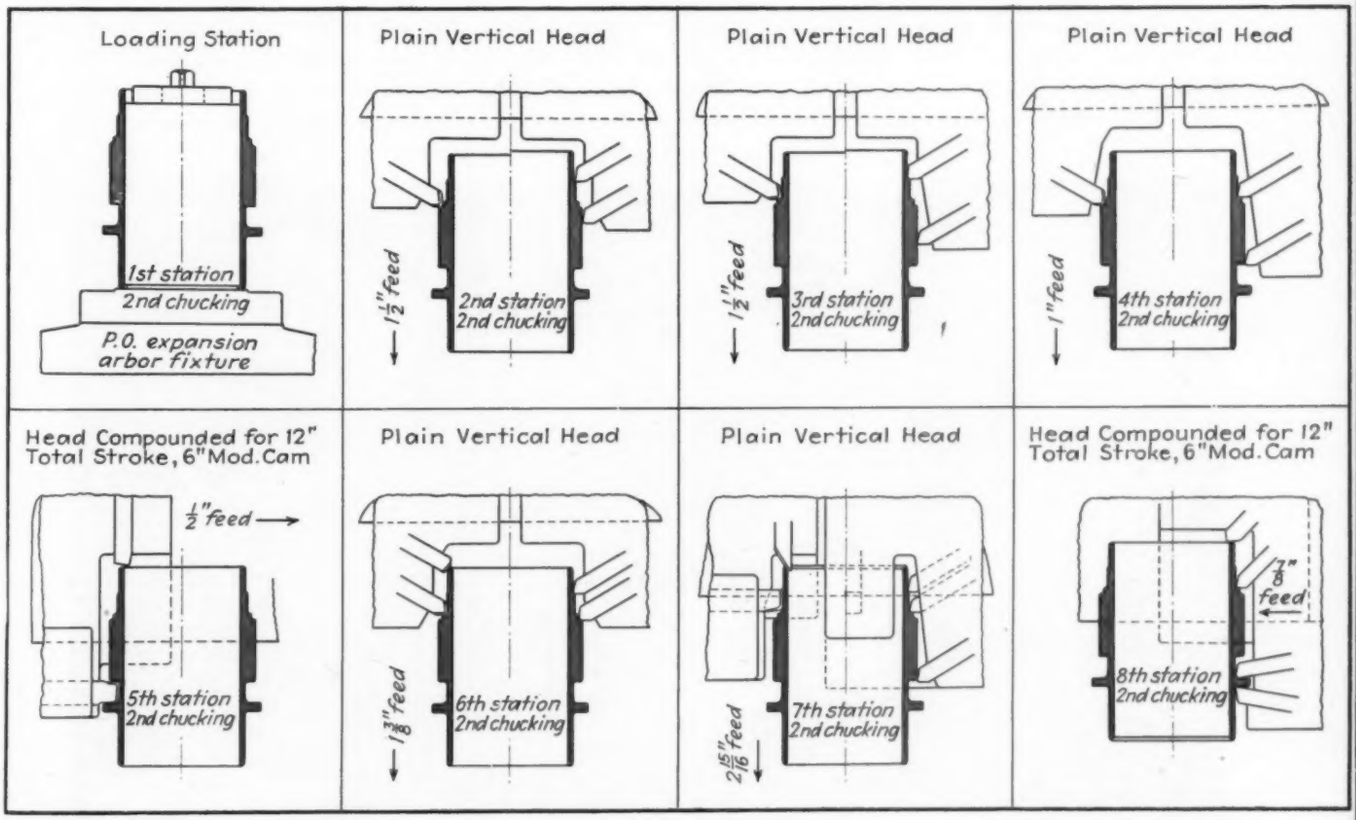
With original production quotas, machine downtime for changing dull tools was not so important, but with present schedules it became essential to shift to carbide tools at certain tooling stations, especially for the boring operations. Records for the rough-boring operation disclose that from eight to twelve pieces were obtained per grind with high-speed steel tools, but that carbide tools will produce about 75 pieces per grind. On the finish boring operation, about four to five pieces per grind were obtained



For rough machining a portion of the barrel O.D. and rough boring the I.D., the cylinder barrel is placed top-end down in the chuck jaws of the first-operation Bullard



Work drawings for the first and second-operation Bullards show the multiplicity of tools applied. High-production tooling of this character speeds output of cylinder barrels, saves floorspace and labor



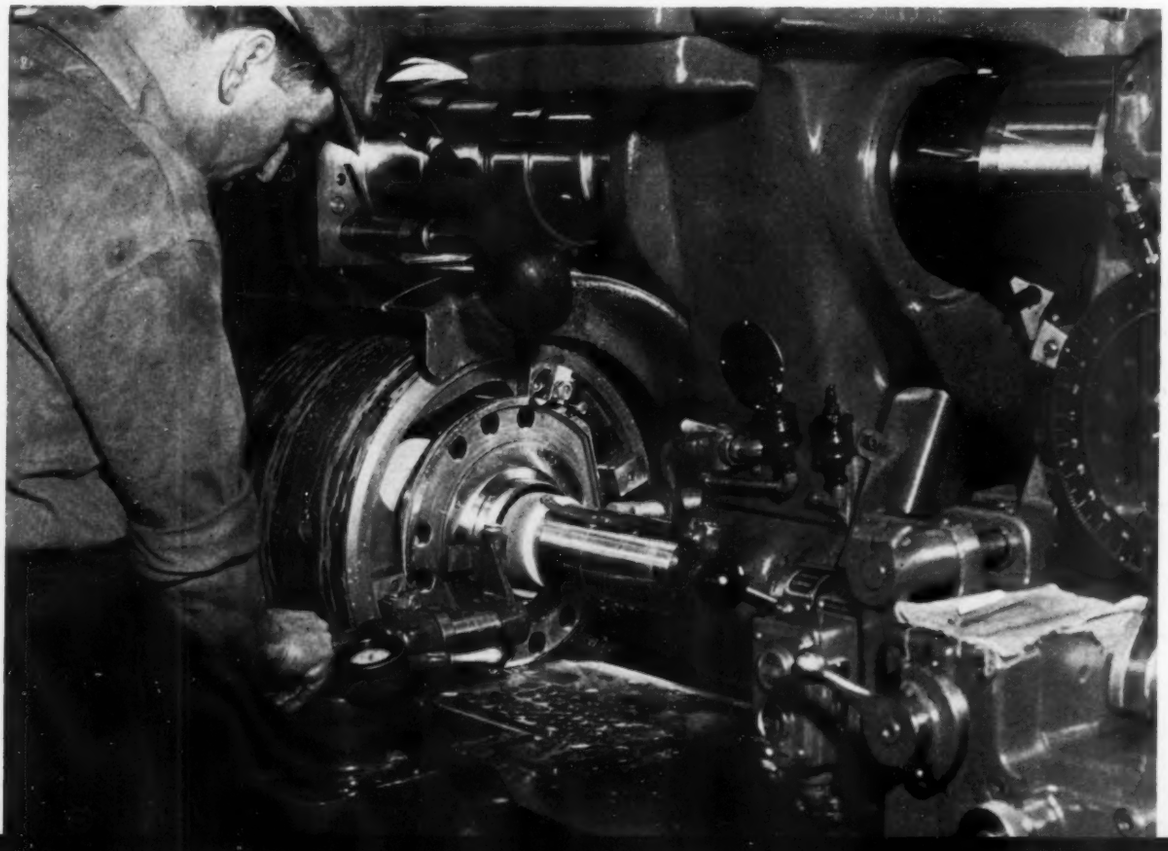
A coarse-pitch thread and a shrink fit are relied upon to hold the cylinder head to the barrel. Here a Jones & Lamson two-wheel thread grinder finishes the thread from the solid. A second wheel, separated from the first one by a spacer, removes the first thread for easy engagement

with high-speed steel tools operating at 40 surface ft. per min., and 0.037 in. feed. That operation is now being carried out with carbide tools at 170 surface ft. per min. and 0.014 in. feed; production over an entire shift is not interrupted for tool changes.

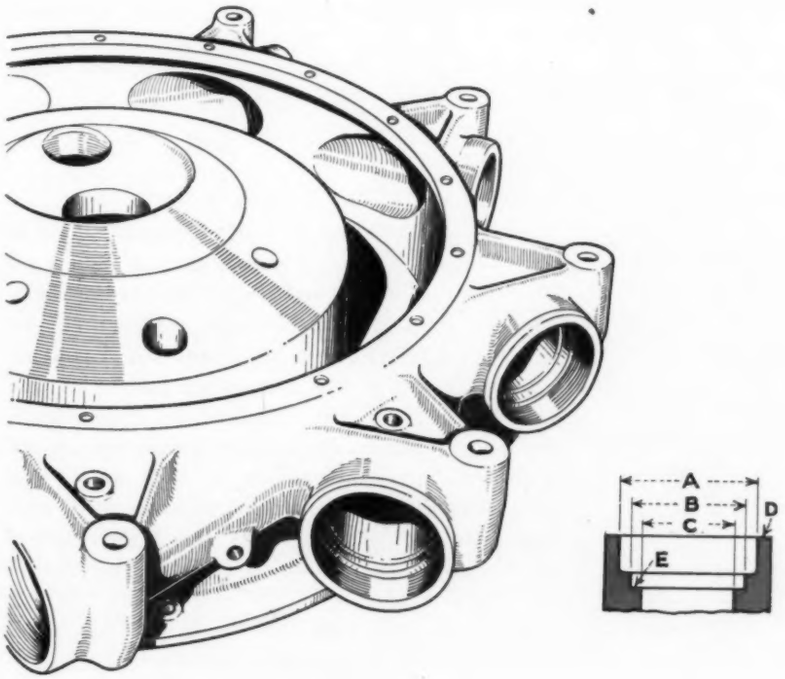
For the several light-metal sections making up the crankcase assembly, Buick specified high-production equipment on certain operations. Machine and fixture principles have been stabilized, but experimentation is going forward to improve tooling, especially to reduce the heat generated in cutting aluminum and nagnesium castings at speeds from 1,100 to 1,500 surface ft. per min. Hydraulic feed is employed. Chips are broad and fairly thick, when taken in spotfacing and boring operations. The front rake angle on Carboloy tool bits was originally specified as 7 deg., but to reduce the heat generated in cutting, the rake angles are being increased to between 15 and 20 deg., and cutting tools are being fitted with a multiplicity of blades, say ten or twelve instead of two or four. Good finish is secured, on both aluminum and magnesium. The fire hazard is removed on magnesium alloys by flooding the work with a cutting compound consisting of one part Vacumul cutting oil to two parts kerosene.

To bore, face and tap several bosses arranged uniformly around the periphery of the blower-crankcase

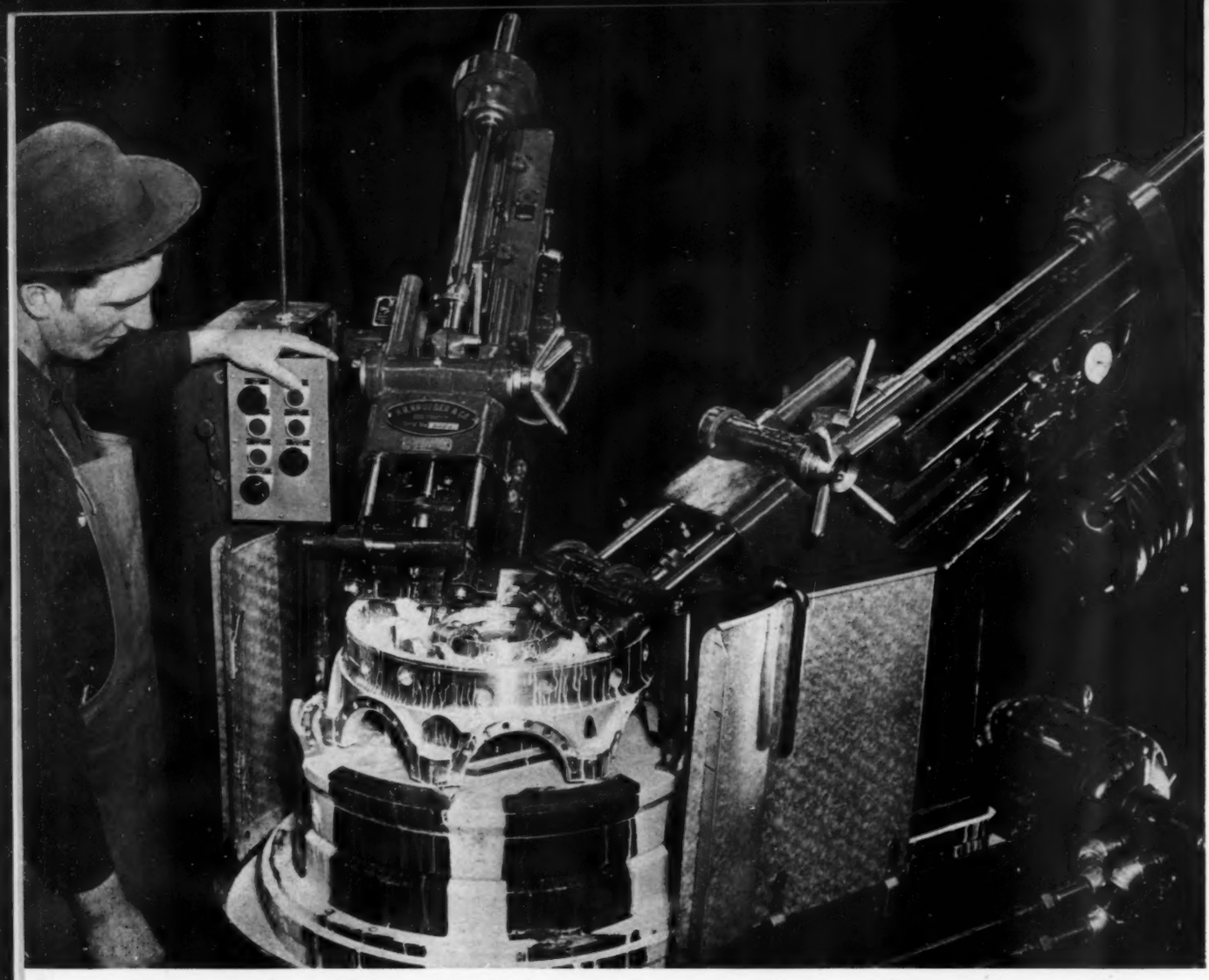
Buick prefers to finish grind the bore and tapered "choke" at the upper end of the barrel after assembly of the head, instead of finish grinding the bore to an empirical contour prior to shrinking the head. The finish grinding operation is carried out on a Bryant chucking grinder, the upper 2½ in. of the bore being ground to 0.0075 in. taper per inch by means of an integral taper attachment guiding the wheel spindle. The finish secured is under six micro-inches



Nine bosses on the periphery of the blower-crankcase section are machined on this Natco five-way machine, which goes through an automatic cycle involving fourteen indexes



Operations on each of the bosses on the blower-crankcase section include: (1) Combination rough bore *A* and *B* and rough face *D;* (2) Combination finish bore *B* and finish face *D;* (3) Combination semi-finish bore *A*, rough bore *C* and rough face *E;* (4) Combination finish bore *C* and finish face *E;* and (5) tap *A*



Fourteen oil holes are drilled in either the front or rear crankcase sections on this Krueger two-way machine. What would otherwise be a tedious operation requiring several machines is thus performed automatically

section, Buick has applied a Natco five-way machine that is entirely automatic once the starting button is pressed. The machine consists of four heavy-duty single-spindle drilling heads and one single-spindle-tapping head. An auxiliary reversing-motor-drive tapping unit is mounted on one head, and the tapping spindle is complete with an individual leadscrew and tap holder. These five heads are radially arranged about the 14-position automatically indexed table. Heads and table are interlocked to operate in proper sequence.

The blower-crankcase section is located from a finished face and the finished bore, and is positioned radially with a pin in a previously reamed hole. The following operations are performed in sequence on the Natco:

Head No. 1—Combination rough bore diameters *A* and *B* (see sketch) and rough the outside face *D*.

Head No. 2—Combination finish bore diameter *B* and finish the outside face *D*.

Head No. 3—Combination semi-finish bore diameter *A*, rough bore diameter *C* and rough face *E*.

Head No. 4—Combination finish bore *C* and finish face *E*.

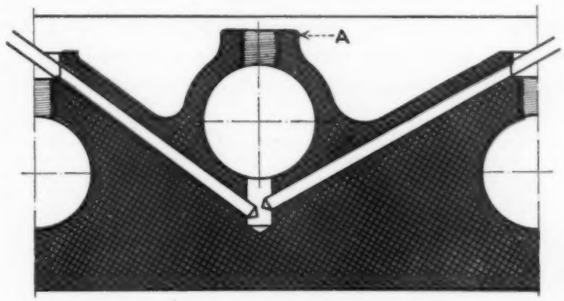
Head No. 5—Tap diameter *A*.

Another example of the automotive technique in tooling up for aviation motors is that of drilling oil holes in the main front and rear sections of the crankcase. Fourteen 5/32-in. oil holes are required. In each pair of holes, one is $2\frac{3}{8}$ in. deep and lies at an angle of 27 deg. to the face of the part, while the other hole is $3\frac{1}{8}$ in. deep and lies at a 35 deg. angle. Drilling these holes individually would require excessive time and labor. Hence the job is applied to a special Krueger two-way drilling machine fitted with an automatically indexing table and Leland-Gifford step-drilling heads. Fast-spiral drills are employed to force out the chips.

The operator lays the part flat on the table, registering it by a pilot engaging the main center hole, and

establishing angular registration with a dowel pin. After racking the bushing plate into position, he trips the starting button and the machine goes through its cycle automatically, indexing seven times and stopping. Thus, the machine tender can operate other equipment in the line.

When the drill heads return to the up position ready for indexing, a limit switch is tripped, and a solenoid valve operates the hydraulic table index. Hydraulic indexing is achieved by a cylinder, change gears and a dwell cam, the last positioning the table while the pilot pin enters the proper bushing in the table. The table in this case is fitted with seven bushings. Furthermore, during indexing the bushing plate would strike the boss *A* (see sketch) if means were not applied to lift it out of the way. Hence, a cam at each table indexing position acts through a linkage to slide the bushing plate back upon its guide bar so as to clear the boss. Coolant is brought to the drilling area by a drilled hole in this guide bar. By merely changing work clamps, either the front or rear main crankcase sections can be drilled on this equipment.



Oil holes are drilled in pairs. These holes lie at different angles to the bottom face of the crankcase section, and the axes of the holes lie at an obtuse angle with respect to each other as shown above

Piloted tools cannot be used for spotfacing two seats at opposite sides of the aluminum main-center section of the crankcase. A two-way Sommer & Adams machine has opposed spindles fitted with two boring, and two spotfacing carbide toolbits per spindle, secures good finish at 1,500 surface ft. per min. The feed is hydraulic. Tooling will be revamped to include as many as ten bits and the front rake will be changed from 7 to 15 or 20 deg. to cut down generated heat.

Pistons Grooved in Two Operations

Tapered ring grooves in the aluminum pistons for aircraft engines are machined on Sundstrand Type D 10x22 automatic stub lathes by the straight infeed method. Two machines are required. In the first-operation set-up, a set of straight tools in the front slide rough forms the grooves. After the front slide returns to the dwell position, the rear slide holding tapered semi-finish toolbits is fed straight into the

Tapered ring grooves, the O.D. and the dome of P. & W. aluminum pistons are machined in two set-ups on Sundstrand automatic stub lathes

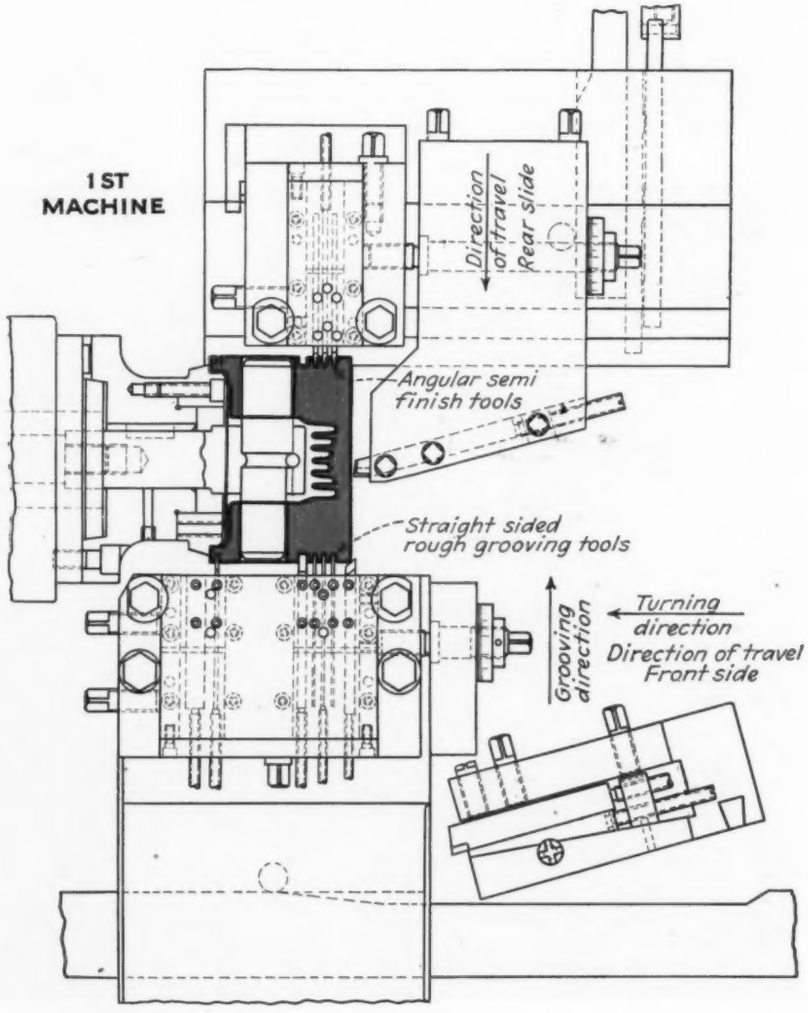
work. At this point, the piston is removed from the roughing machine and transferred to the finishing machine, which has a set of tapered finish grooving tools in the rear slide. Both lathes of course perform additional operations: the finishing machine, for example, having tools to face the top of the dome, turn the piston outside diameter, and break the corners for burrs.

Straight infeed is employed for the grooving operation because it is easier to maintain the size of the groove with a definitely ground angle tool than to employ the generating method, which depends upon an angular infeed motion, in which two tools must be set to definite limits to maintain size. In other words, it is easier to maintain the straight infeed setup for production, and only one tool must be maintained by the toolroom.

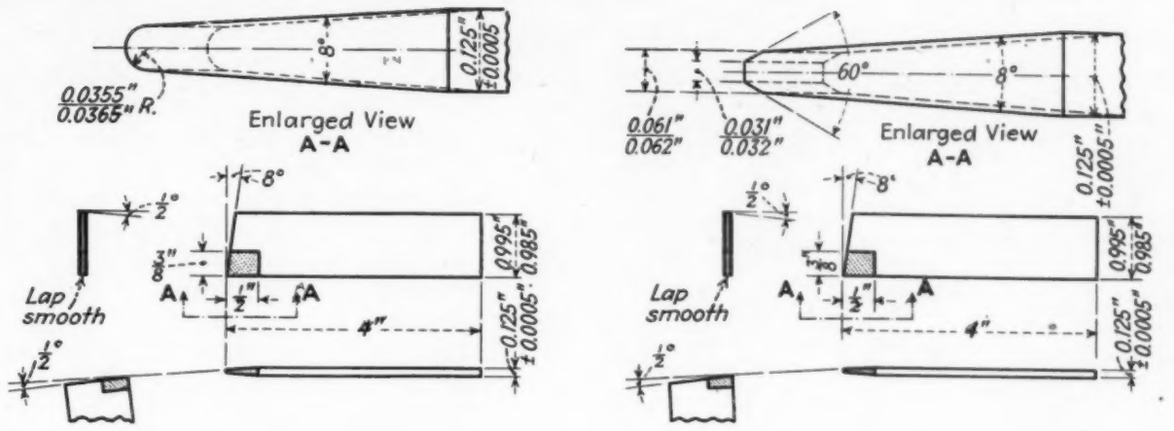
The stub lathes have two feeds and speeds. When facing the dome and turning the O.D., the speed is 480 r.p.m. with 0.008 in. feed per revolution. The machine shifts automatically to 130 r.p.m. and 0.0015 in. feed when grooving.

Automotive experience can be applied to problems of materials handling in an aviation-motor plant, even though conveyors will be limited. To hold bulky parts, like aluminum-alloy crankcase sections, in a minimum space at machine stations and provide maximum safety to the work, a shelf-type rack has been developed. Each of the several plywood shelves is hinged to swing up to the vertical position when not loaded, to swing down to the horizontal position to receive a workpiece. Shelves are offset from the vertical centerline of the rack to prevent the device from tipping over when fully loaded. Each rack is mounted on wheels.

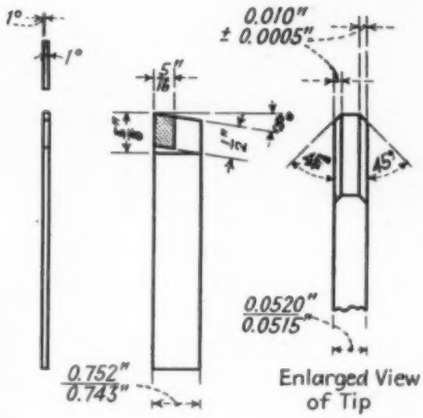
Conveyors will probably be installed in the heat-treating department, but elsewhere trucks will be depended upon to move material from machining lines to inspection, bonded storage and final assembly. To minimize the number of power-operated

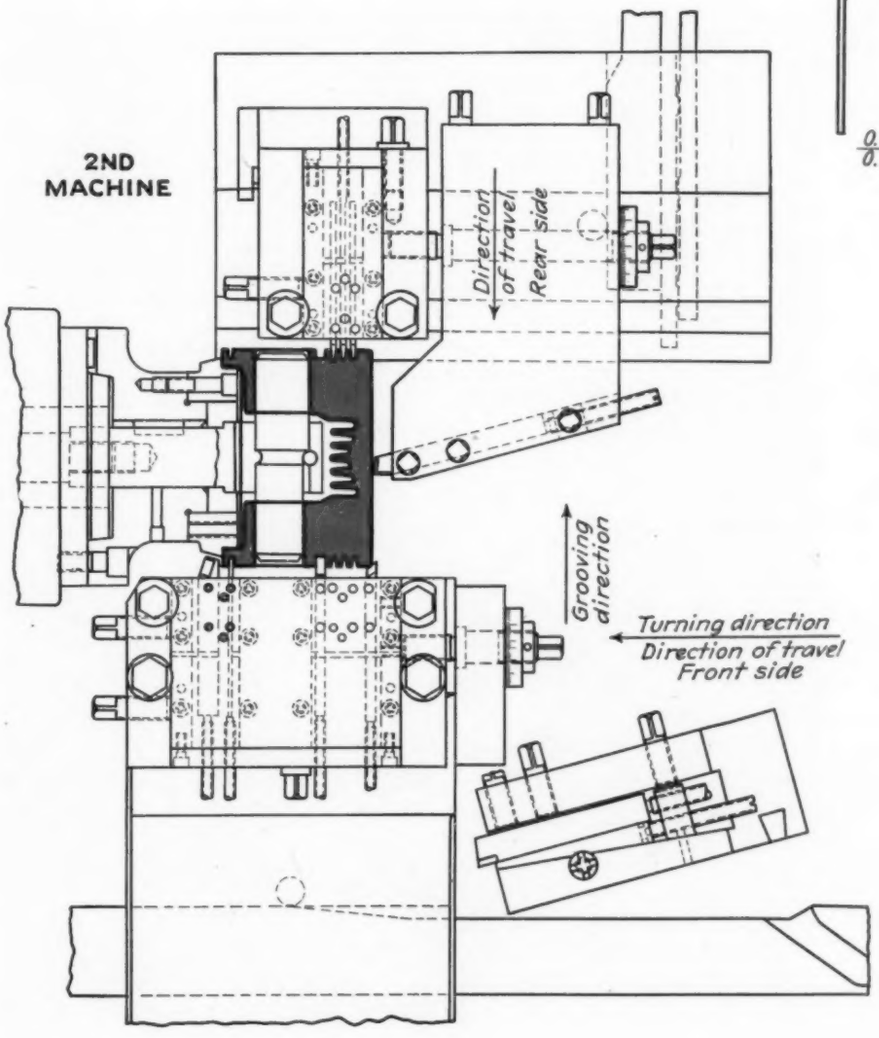


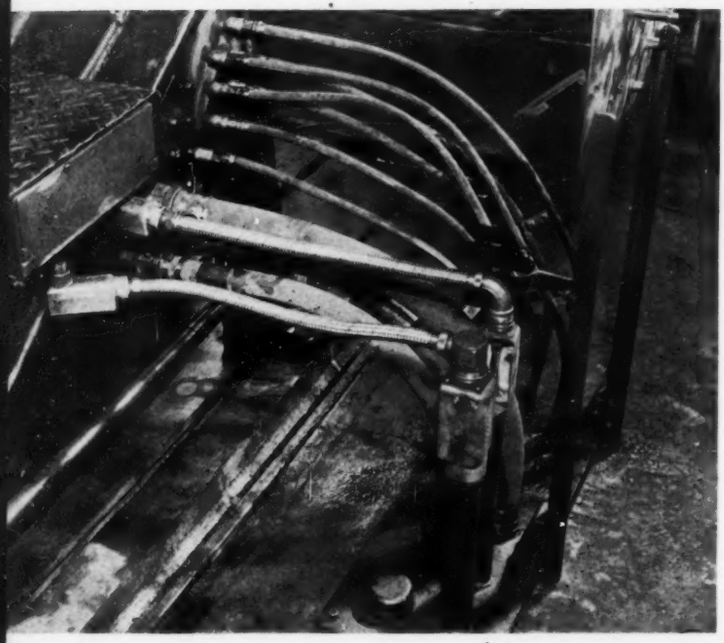
Sequence of machining the tapered ring grooves: First machine — straight-sided tools in front slide feed straight in to depth and return; tapered semi-finish tools in rear slide leave about 0.005 in. per side. Second machine — round-nosed taper finishing tools finish the grooves to 0.001 in.



Tool grinding and machine set-up problems are simplified with straight infeeding tools. The generating method, avoided by Buick, poses problems of controlling angular tool motion when machining the tapered sides of the groove







From three to six hours are ordinarily required to connect the electrical, oil, gasoline and exhaust connections when setting up an aviation motor for testing. Buick engineers devised a system of "plug-ins" whereby the test crew can make the connections in 45 min. or less

trucks required, racks of several types are being developed for a variety of purposes.

An example is the table-type rack that holds enough cylinder assemblies for two engines. The cylinder head is awkward to pick up, dangerous to stack because it topples easily. The assembly is slipped over a rounded wooden button, held securely against toppling. The rack sits upon a wheeled truck, which is picked up by a fork-type pallet truck and transported to various plant stations such as shotblasting, metallizing, bonded storage and final assembly.

The wheeled truck is used for spotting the rack at the desired point at the machine, or a hoist can be used to lift the rack off the truck. At such stations as shotblasting and metallizing, the cylinder head assembly is removed from the rack easily and then replaced after the operation. A minimum amount of handling of each piece is thereby secured, which is desirable to reduce fingerprints on polished steel, avoid scratches and cracks.

A shelf-type rack holds bulky crankcase sections in minimum space at machine stations. Hinged shelves make it easy to get at successive pieces

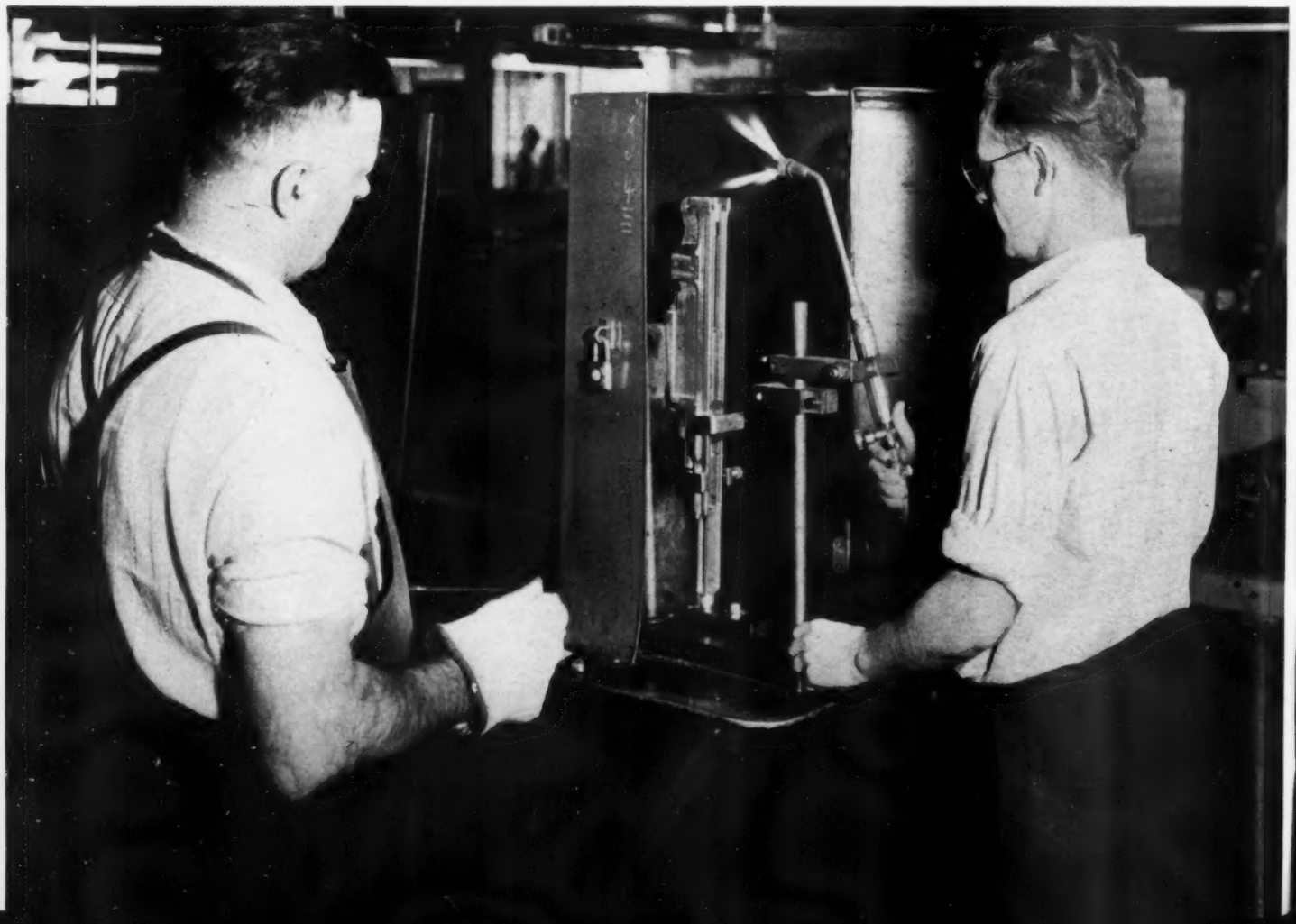
Cylinder-head assemblies move on table-type racks from assembly inspection to shotblasting, metallizing, final inspection, bonded storage and final assembly. Each cylinder assembly is held upright by a wooden button, can't topple, is presented in the best position for removing the awkward piece at processing stations

Gasoline burned in motor testing is largely converted into power for electric heat-treating furnaces. Here a General Electric furnace is heat-treating gears to close metallurgical specifications

Machine Guns

The bottom of the counterbore for the gas cylinder in the front end of the Bren body must be located within about 0.0005 in. in relation to the start of the thread, so the gas cylinder will seat in its proper location when fitted in the field. This surface is finished by hand to insure accuracy

Four stops inside the finished Bren body must be hardened without affecting the rest of the part. To accomplish this, a special oxyacetylene torch having a tip which projects four flames in proper directions is employed. The torch is pivoted so that it can be swung by hand to the correct position inside the clamped body. Fire clay is packed around a bridge inside the body to prevent overheating. About 60 sec. are required to bring the four surfaces to proper temperature, then the part is lifted from the stand and quickly plunged into an oil quench tank



from "TASK" Operations

Finish boring of the gas cylinder hole at the front end of the Bren gun body is one of the most important of the 200 machining operations performed on this forging. A two-spindle Heald Borematic is used, each spindle carrying carbide-tipped bits. The first spindle rectifies the 0.627-in. gas cylinder hole at 3,500 r.p.m., while the second spindle finish bores the three-diameter gas cylinder seat at 2,300 r.p.m. Table feed is 3½ in. per min. The fixture is indexed from side to side against stops to bring the body alternately in line with the first and second spindles

CANADIAN INGENUITY and hard work have achieved, in the short space of three years, an automatic arms plant already rated as one of the largest in the world. Starting from scratch, the management of this plant has had to bring together hundreds of machine tools, make or purchase thousands of fixtures, tools and gages, and to employ and train a large supervisory and production force. To date, more than 8,000 men and women have been trained "from the ground up" to perform the approximately 5,000 machining operations and the almost equally large number of fitting, assembly and inspection operations necessary in the manufacture of the three automatic guns being made in this plant.

At present more than two-thirds of the working force are girls. These girls are machining parts having dimensional tolerances of half a thousandth or less. They are operating drill presses, engine and turret lathes, rifling machines, rise-and-fall milling machines and surface grinders with as much success as the men beside them who have had comparable training. Girls also are finding employment in this plant as parts inspectors, messengers, crib attendants, tool and gage chasers, and several are proving satisfactory on tool and gage inspection. In the production departments no difference is made between men and women employees, so far as hours and conditions of work are concerned. Girls work both day and night shifts.

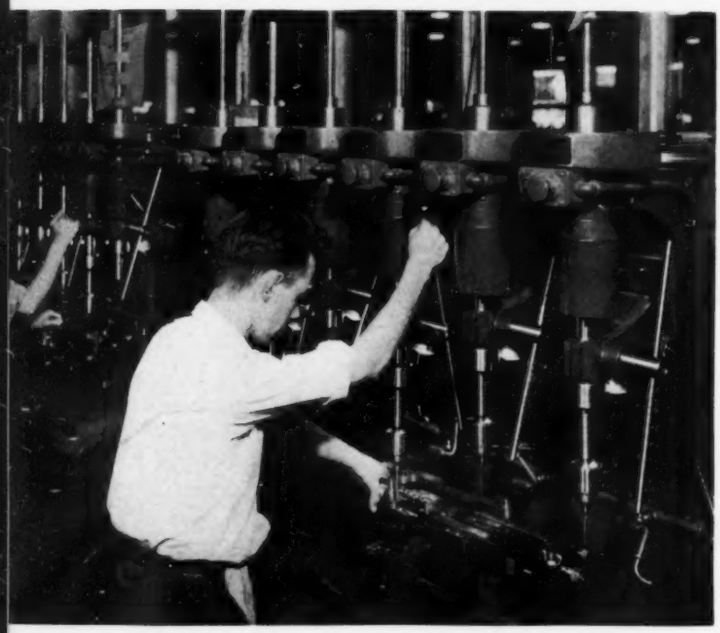
Few of the present force of production employees have had any previous metal-working experience, and none had ever before been employed in plants manufacturing machine guns. However, the management has, by careful attention to details, been able to train these employees for simplified "task" operations as machine operators, bench fitters, assemblers and inspectors, to the extent that each employee now is a "specialist" on his or her particular job.

From the start, the management has maintained that it is better to spend a few extra dollars in the toolroom in providing high-quality fixtures, jigs, tools and gages, than to try to economize on tools and be faced with the probability of heavy rejections after costly operations have been performed. This policy already has paid dividends. Not only have deliveries been kept well ahead of schedules, but rejections have been held at a surprisingly low level.

Line production methods have been adapted, in so far as possible, to the manufacture of parts for machine guns in this plant. Each component is made in a separate group, and the machines in each group are arranged so that the parts move progressively down the line for each successive operation. Several factors have contributed to the success with which

such methods have been employed. These include careful planning of each operation, with the work being broken down into tasks as much as possible, so that the operators can be trained quickly; careful tool and fixture design, so that these units are as foolproof as possible; and the frequency with which the parts are inspected.

A complete set of production gages is provided at each machine and bench work station. All parts finished at that machine or station, are checked by the operator, and at frequent intervals by floating "viewers" then after four or five operations have been completed, the parts are taken to an inspection bench for checking against the drawing with another set of gages. At each of these inspection stations, the parts are checked 100 percent for all previous operations. This insures against performing expensive machining operations on parts already made to wrong dimensions.



Two side plates, a bottom plate, back plate and top plate, together with several brackets and cams, are assembled to the trunnion block to form the Browning case in a series of drill press and bench operations. Later, the barrel casing is sweated into the trunnion block

The management has depended to a large extent on the War Emergency Training Schools sponsored by the Canadian government for the training of machine operators, welders and other specialists. When the war started, Canada did not have a large backlog of trained men, so it has been necessary to use the available skilled men in the manufacture of tools, and in building up a supervisory staff; meanwhile training as rapidly as possible the large number of operators necessary for war-time production. Courses in the emergency training schools are jointly sponsored by the various companies, and by the Canadian government, and each student is given a subsistance allowance by the government while he is taking the courses offered.

The procedure followed is somewhat as follows: The company first advises the school that it will require a given number of trainees with school experience in specified operations. The school selects and sends to the employment manager of the company a number of prospective students who fill out regular employment application blanks, and are interviewed. The school then is advised which of these applicants might be acceptable for employment, and the school undertakes to train these selected applicants to meet the requirements of the jobs that are open.

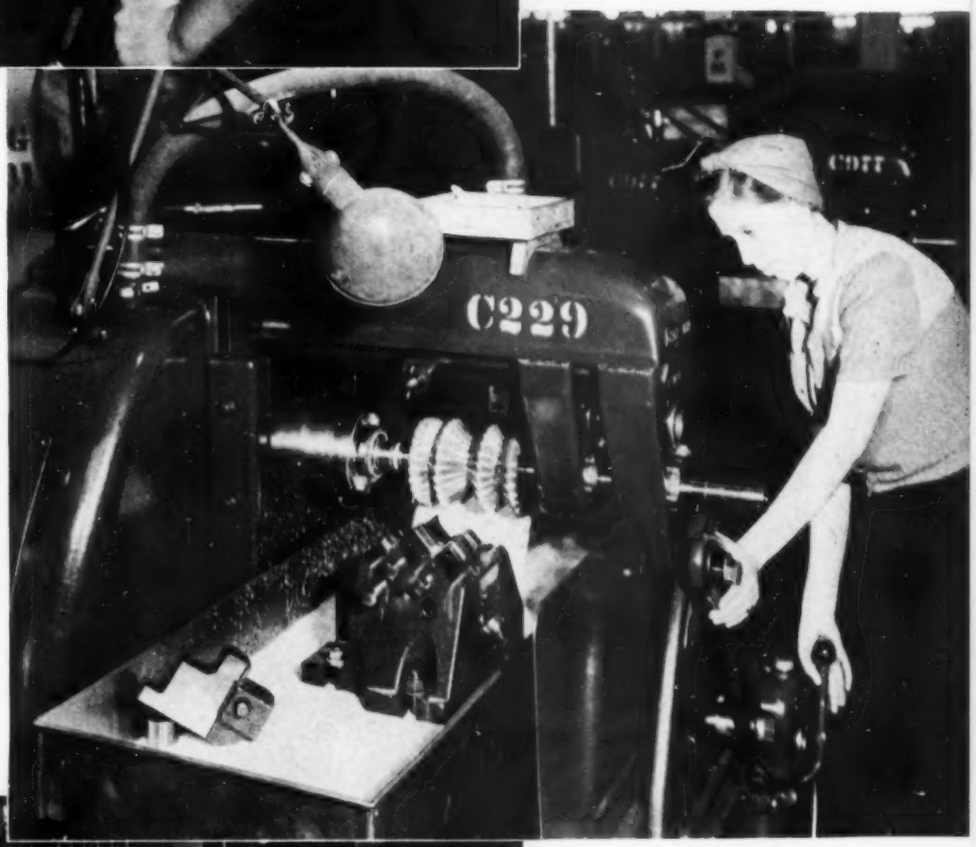
In most cases the school provides instructions according to a schedule of training specified by the prospective employer who, during the course of training, sends a representative to the school at frequent intervals to observe the progress of individual students. If the student satisfies his instructor and the employer's representative during the twelve-week course, he usually is sure of a job. Employment is not guaranteed, and no contract is entered into when the student is sponsored in a school class.

Short Courses for Specialists

Special classes in inspection, welding, tool set-up and the like are maintained on a part-time basis for selected employees. Men go to afternoon or evening classes for nine to twelve weeks while still working on their regular jobs, and while off duty. Where the school staff cannot provide instruction, the plant sends specialists to conduct the classes. Usually, these classes are organized for the purpose of upgrading employees to jobs of more responsibility and better pay. Here they are initiated to provide trained men to fill specific needs, rather than to offer all of the employees a chance to get a better job.

Whether hired for a shop or an office job, every new employee spends the full eight hours of his first day of employment in a lecture class where the company's supervisor of training, or one of his assistants, points out to each day's group that they are entering a war industry, and that there is a serious purpose for the work they will be asked to do. The company's policies are explained in some detail, and an attempt is made to show the new employees that they should be proud of having a job in a war industry. The desire is to develop an attitude of mind toward the

Last of the 17 bench and machine operations required to finish Bren backsight cams from bar stock involves finish grinding of the cam circumference to within 0.0002 in. of the required contour. Prior to this operation, the pieces are case hardened to about 67 Rockwell D with a 0.015 to 0.020 in. depth of case



Second machining operation on trunnion block forgings for the Browning machine gun consists of form milling six surfaces in a Hydromatic miller, using high-speed steel cutters at about 80 to 85 ft. per min. with a feed of 1½-in. per min. The four cutters in the set-up will do about 100 pieces before they must be resharpened.

At the end of the machining line, the Browning trunnion block is carefully fitted to gages, burred and polished at a work bench. Top of the bench is covered with fiberboard, and a rack in front of each workman holds the gage where they will not be damaged. Most bench operations are performed by carefully trained men; girls have proven more satisfactory for machine operations

work that will insure continuance of accurate production. The Official Secrets Act is explained in detail, in order that the new employees will not unconsciously give away military secrets of which they may learn details.

During the full-day lecture, the supervisor of training covers many points. Conveniences and privileges provided by the company are explained in detail and the product is discussed from the standpoint of creating interest in the work and in the necessity for accuracy and precision. The several guns being manufactured in the plant are demonstrated, and the purpose and function of individual components is explained. This helps emphasize the need for making each small part accurately.

From the start of his or her second day of employment, the new employee is out in the shop on the production line. Here, on-the-job training is in the hands of the foreman, supervisor, lead-man or tool setter having direct supervision over the individual operator. At first, the operator is taught to do only one operation. He learns by experience how the part must be positioned in the fixture, and how the machine is operated. He learns, also, how to determine whether the cutters are performing properly, and when they should be removed for sharpening. Meanwhile, he is learning how to use and care for his gages. Later, a few operators may be transferred to other machines so that they can learn to perform several operations, and so make themselves more valuable.

The company has found that girls excel as machine operators and inspectors, but has not as yet found it necessary to use them extensively for finishing work at the bench. For such operations, they have employed a fairly large number of men, either over age or physically unfit for military service. These men have the patience necessary for such work, but are not active enough to stand up at a machine all day.

Final fitting of the case assembly is done at bench vises where special wood jaws position the assembly. About 30 gages are used to check for size and alignment. This man is using a safe-edge file to finish the slot for the cartridge stop, which must be located accurately

Power Hack Saw Blades

Courtesy Henry Disston & Sons, Inc.

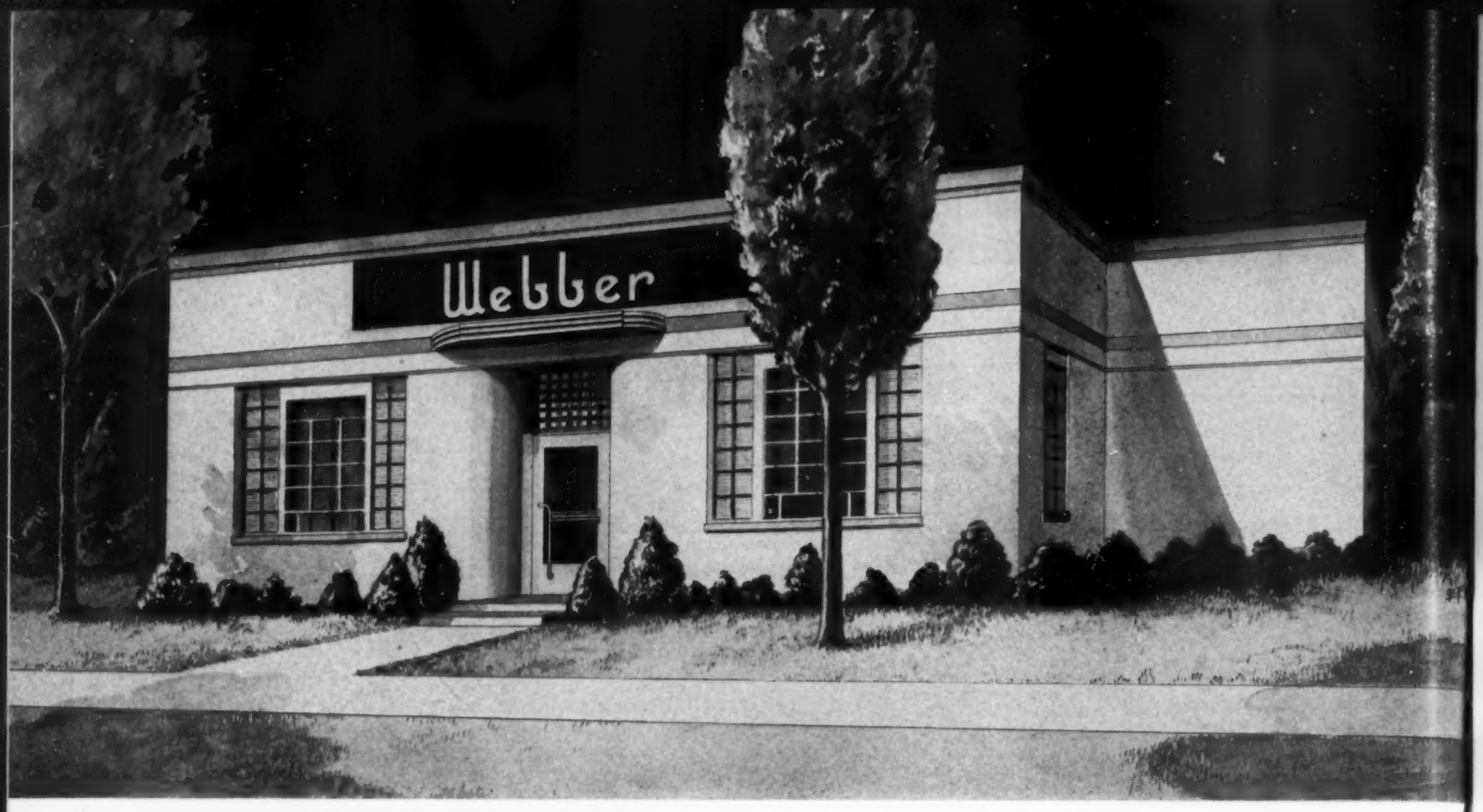
How to obtain greater efficiency and make blades last longer.

FAILURE	CAUSE	CORRECTION
Pulling out at pin hole	Blade drawn too tight.	Reduce tension on blade. Allow just enough to hold it straight and prevent twisting.
	Blade twisting in cut.	
Premature wear	Feed too heavy.	Reduce . . . see recommendations.
	Speed too great.	Reduce to recommended speed.
	Incorrect tooth spacing.	Use number of teeth recommended for material.
	Insufficient feed.	Increase feed as recommended.
	Dry cutting.	Use coolant.
Stripping teeth	Tooth spacing too coarse.	Use number of teeth recommended for material.
	Teeth too fine for material.	
Crooked cuts	Worn frame.	Check machine for wear and adjustment.
	Frame out of line with vise.	
	Blade loose in frame.	Adjust.
	Stock not tight in vise.	Inspect clamps and tighten.
	Feed too heavy.	Reduce . . . see recommendations.
	Wornout blade.	Install new blade.
	Hard spot in material.	Start new cut. May require new blade.
Blades breaking	Insufficient tension.	Make adjustment.
	Tooth spacing too coarse.	Use number of teeth recommended for material.
	Feed too heavy.	Reduce . . . see recommendations.
	New blade in unfinished cut.	Start new cut.
	Side strain on blade.	Worn out. Change blade.

This material appears on the control cards used in the Disston Conservation Plan.

RECOMMENDATIONS

Material	No. Teeth Per Inch	Strokes Per Min.	Feed In Pounds	Material	No. Teeth Per Inch	Strokes Per Min.	Feed In Pounds
Aluminum	4–6	135–150	60	*High Speed Steel*	6–10	90	120
Brass—Cast—Soft	6–10	135–150	60	*Machine Steel*	4–6	135	150
Brass—Cast—Hard	6–10	135	60	*Iron Pipe*	10–14	135	120
Cast Iron	6–10	135	120	*Structural Steel*	6–10	135	120
Copper	6–10	135	120	*Tubing—Steel*	14	135	60
Tool Steel	4–6–10	90	120	*Tubing—Brass*	14	135	60
Cold Rolled Steel	4–6	135	150				



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Flexible Back Metal Band Saws

Courtesy Henry Disston & Sons, Inc.

How to obtain greater efficiency and make saws last longer

FAILURE	CAUSE	CORRECTION
Stripping teeth	Tooth spacing too coarse.	Use recommended spacing.
	Starting cut at extremely thin section of material or on a corner.	Start cut where several teeth will contact material at same time.
Premature wear and loss of set	Speed too fast.	Reduce — see recommendations.
	Rubbing in guides.	Adjust so that teeth project beyond guides — also so that teeth project over edge of wheels.
	Riding on wheels.	
Breaking	Twisting in the cut.	If irregular cutting, use proper width saw for radius.
	Misalignment of guides.	Adjust so that top and bottom guides are in alignment.
	Guides set too far apart, allow band to twist.	Always adjust guides as close as possible to piece being cut.
	Insufficient tension.	Adjust tension to approximately 300 lbs. per inch of saw width.
	Allowing band to remain in tension when not in use.	Remove saw from machine or release tension. Where extreme differences of temperature occur, this practice will prevent breakage.
Cutting out of line	Misalignment of guides.	Adjustment should be made.
	Spacing of guides.	Set as close as possible.
	Set worn on one side due to contact with wheels or guides.	Adjust so that teeth project beyond guides — also so that teeth project over edge of wheels.
	Feed too heavy.	Reduce feed or use coarser tooth saw.

This material appears on the control cards used in the Disston Conservation Plan.

Width of Band Saw	To cut minimum radius of
$\frac{1}{16}$ inch	$\frac{3}{32}$ inch
$\frac{3}{32}$ inch	$\frac{1}{16}$ inch
$\frac{1}{8}$ inch	$\frac{1}{4}$ inch
$\frac{3}{16}$ inch	$\frac{7}{16}$ inch
$\frac{1}{4}$ inch	$\frac{3}{4}$ inch
$\frac{3}{8}$ inch	$1\frac{1}{2}$ inches
$\frac{1}{2}$ inch	$2\frac{1}{4}$ inches
$\frac{5}{8}$ inch	3 inches
$\frac{3}{4}$ inch	$4\frac{1}{2}$ inches
1 inch	8 inches

Recommended specifications for cutting specific materials with Hard Edge Flexible Back Metal Cutting Band Saws

Material	No. Teeth Per Inch	Speed of Blade, Ft. Per Min.
Aluminum solids	8–10	800–2500
Sheets	8–10	1000–3000
Aluminum alloys		
Solids	8–10	100–150
Irregular shapes	12–14	200–300
Asbestos sheets	8–12	150–200
Babbitt	10–14	1000–1500
Bakelite	8–10	800–1000
Brass castings		
Soft	10–14	700–1500
Hard	10–14	200–500
Brass sheets and tubing	14–18	700–1500
Bronze		
Bars	10–14	150–350
Castings	10–14	300–800
Mouldings	14–18	500–1000
Cast iron	12–14	100–125
Catalin	12–14	700–800
Copper	8–12	500–1000
Copper—Nickel	12–14	70–90
Everbright	10–12	150–350
Everdur	10–12	150–350
Fiber	8–10	300–500
Formica	8	300–500
Hose—canvas and rubber	8–10	500–1000
Hose—metallic	18–24	250–500
Inconel	10–12	70–90
Iron bars	12–14	100–125
Iron sheets (under $\frac{1}{32}$")	14–18	100–250
Metal wood	12–14	300–750
Mica	10–12	300–600
Micarta	8	300–500
Monel metal	10–12	100–150
Nickel silver	18–24	100–150
Pipe	14–18	100–200
Radiator core	18–24	150–400
Rubber—hard	10–14	150–200
Slate	10–14	100–150
Steel—Chromium	12–14	90–125
Cold rolled	10–12	100–125
Drill rod	14	100–125
Heat resistant	12–14	90–125
High-speed	12–14	90–125
Machinery	10–14	100–125
Manganese	10–12	90–100
Nickel	10–14	90–125
Structural	10–14	90–125
Tool	12–14	100–125
Tubing	14–18	100–150
Textolite	8	300–500
Transite	8–12	100–200

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Cooperation: A Two-Way Affair

INDUSTRY IS STEPPING up to its newest assignment without holding back. It is putting into its war job the same restless and untiring energy, the same ingenuity and the same skill that it formerly threw into its normal, peacetime operations. It is cooperating heartily in the all-out production program.

But cooperation is a two-way affair. Let's admit that the Government has had to assemble in haste new agencies to prosecute the war. Let's admit that bad as well as good decisions and a certain amount of overlapping of operations and of fumbling were inevitable. Let's admit also that international developments involving Uncle Sam have come so fast and furiously that many drastic actions have had to be taken on little or no advance notice.

With due allowance for all of these factors, it is fair to say that Uncle Sam persists in doing things that hamper as well as expedite the war production effort.

Take questionnaires, for example. Industry is being questionnaired to death. No one will quarrel with Washington's need for full facts and figures bearing on industrial facilities and on war production. But when various Government agencies seek the same sort of data without relation to or knowledge of what each other is doing, it is time to call a halt. After seeing some of the questionnaires sent out by Washington, we sympathize with the industrialist who asked, "When, oh when will the Government stop asking us for so much useless detailed information, which takes weeks to gather, and let us get down to the business of making war goods?"

Take materials as another example. If Washington finds that a scarce material must be conserved, it is abruptly cut off from essential war industries without warning. Frantic efforts must then be made to avoid interruption of production.

To illustrate: The order restricting the use of rubber, issued January 23, is not intended to preclude its employment where necessary in an essential industry. Yet there still is misunderstanding between rubber producers and machine tool builders as to whether the latter are entitled to any rubber at all. When the need for V-belts, hose for coolants and other items is considered, it is obvious that machine tool builders must have rubber if they are to do their war job.

In a similar way nickel was abruptly cut off, though its use is essential for some machine tool builders in some places. To secure modern feeds and speeds without greatly enlarging the size of the machine, the machine tool industry has resorted widely to alloy steels. Yet Washington gave the industry less than ten days in which to discontinue completely the use of nickel steel and in which to find a substitute.

Space forbids mention of other arbitrary and perhaps unnecessary actions ordered by Washington. We make a plea, however, for greater tolerance, more understanding and more forward planning on the Potomac.

Intelligence, persuasion and cooperation are qualities which both industry and Uncle Sam should cultivate in these war days. Such qualities will be more effective in achieving our war goal than hasty, ill-considered decisions and arbitrary commands.

Burnham Finney

GAGING BUSINESS

"War Cabinet" finally set after two years of trial and error. Companies schedule record machine tool orders. Arms production booms. Ships short, no remedy visible. Plane rise predicted.

The most encouraging news to come out of Washington in recent weeks was the establishment of a "War Cabinet" out of the muddling of the past two years have emerged five strong men: Donald M. Nelson, production boss at the head of the War Production Board; Paul V. McNutt in charge of mobilizing manpower; Leon Henderson, Controller of Civilian Supply, Prices and Inflation; and Henry A. Wallace and Milo Perkins, battle leaders on the world economic front. Many powerful administrators have fallen by the wayside through their failure to do the job.

From the War cabinet we can expect to get better direction of the entire war effort. McNutt's job looms as the most difficult. Well over 15,000,000 workers will be needed to complete the war effort at home.

Machine Tools—Machine tool companies still are trying to straighten out and schedule the unprecedented mass of orders which came in during March. Orders then were placed in such haphazard fashion that delivery dates had to be figured out after the rush was over. Never in the history of the industry have been builders been so swamped. The reason why many contractors with top priority ratings had not previously ordered their machine tool requirements was because they had not found out from Washington exactly the size of their production problem. Obviously the type and quantity of equipment purchased would depend in large measure on the volume of output expected. Several machine tool builders are in the midst of large plant expansion programs, the new factory additions to be ready sometime this summer. However, the industry as a whole is relying upon its present facilities, greatly enlarged the last two years, plus subcontracting to do the tremendous job cut out for it. The bulk of machine tool companies now are on a three-shift basis, and the working forces on second and third shifts are being increased as rapidly as possible. A large part of the industry is on a round-the-clock schedule seven days a week. Washington is continuing to work out plans for shipping more machine tools to Russia to fulfill the pledge of all-out aid to the Soviet. The industry is relieved to know that the proposed stamp plan for allocating machine tools has been discarded.

Munitions—While the last segments of civilian industry are going through the conversion mill, America's mass production skill is beginning to turn out an astronomical amount of arms. Almost everyone working on war products is far ahead of the original schedules, although many thought two months ago that they were unapproachable. The peak estimated expenditure for war goods was once $5,000,000,000 per month. That figure should be reached by June, with many expansions and conversions of industry still not completed. Thus, America's output may be $10,000,000,000 monthly when the arsenal of democracy is completed.

Shipbuilding—When one bottleneck in war effort is broken, another always jumps up to take its place. The production of tanks, guns, planes and the other arms is rolling on high. Now, the most serious challenge to successful prosecution of the war is the need for ships to take the weapons to the far flung fighting fronts. Early estimates of the need for ships were far too low. Sights were first set at 6,000,000 tons, were recently raised to 8,000,000 tons for 1942. They should have been aimed at 10,000,000 or more. We will be lucky to get 8,000,000 tons this year. New yards and ways, which are being started, will not be completed in time to turn out vessels before very late 1942 or early 1943. Greater effort, particularly by the big yards, will help boost production rate. Admiral Land says there has been too much loafing, and others have indicated that it is the big yards who are slow. Further acceleration may come from "production line" construction such as that getting a trial in the Higgins yards, down in Louisiana. Unofficial reports indicate that Higgins has developed a production line method in many ways comparable to that used so successfully on automobiles. The stew over ship shortage may make a goat of steel tough Admiral Land, and he may lose his job as head of all U. S. merchant shipping. Joseph P. Kennedy may take over.

Aircraft—Aircraft production is going well in the sense that it is now at a monthly rate in excess of 3,300 planes. But, inability of the services and the aircraft makers to settle on designs has held down output. Sometime during the Summer production will rise sharply for by that time designs will be settled on most ships.

Tanks—The U. S. now is turning out more tanks than the Axis, but before long we may decide that tanks are not as useful as mobile heavy and light artillery. The Army is in the market for many self propelled gun mounts, also rapid moving vehicles for mounting anti-tank guns.

War Output Soars—The barometer of America's war production—monthly payments for arms and munitions—soars encouragingly higher and higher. March expenditures reaching the unprecedented figure of $2,987,000,000. By June payments will amount to $5,000,000,000 monthly, the goal set by the Victory Program. It seems likely now that with the great mass production machine getting in high gear that at the year end about $7,500,000,000 will go out for arms each month

MANPOWER COMMISSION STEP TOWARD LABOR DRAFT

Will set labor policy of all agencies, establish priorities and centralize training

WASHINGTON—Creation of the new War Manpower Commission with Paul McNutt at its head does not, in itself, inaugurate an actual "labor draft." But it's a long step toward it. Not only does WMC provide the framework to administer such a system when it comes, but McNutt is already drafting legislation, at the instruction of the President, to effect a labor draft.

The commission is made up of representatives of the departments of War, Navy, Agriculture and Labor, and the War Production Board, a new labor production division of the WPB, the Selective Service System and the Civil Service.

Sidney Hillman, who had been touted for the job that McNutt got, has been kicked upstairs from his post in the labor division of WPB to a job as special advisor to the President on labor. Impression in Washington is that for all practical purposes Hillman is back in civil life. The labor division, curtailed by removal of its labor supply and training functions and re-named the Labor Production Division, still lacks a chief.

Sets All Labor Policy

The new commission is empowered to set the labor supply policies of all the federal agencies concerned, including some aspects of the Selective Service. Late in April, it was not yet certain just what lines McNutt would take, but it was clear that he was faced by two major jobs.

One is to find people to fill the 10,500,000 new skilled and semi-skilled jobs that will be needed in war production this year. This will be a tough one and will involve a vast amount of training to fill out the ranks of skilled trades in which shortages have already developed. Thus there are already 51 jobs for every available tool designer, 25 for every tool maker, 7 for every ship carpenter, 22 for every marine machinist, 4 for every aircraft riveter.

To do this it will be necessary to coordinate closely the training activities now scattered among the WPA, the WPB, the Office of Education, the NYA, the CCC, the Committee on Apprenticeship Training (transferred from the Labor Dept. to the Federal Security Agency), and others.

Will Set Labor Priorities

The second big job is that of routing men and women newly trained or now working into the places they are needed most—the establishment of priorities in labor. In the first instance this obviously means installation of procedure in the various recruiting agencies such as the Civil Service and the U. S. Employment Service to give help first in the filling of war needs.

Later, it may mean requiring employers to do all hiring through certain agencies: the Employment Service, certain unions in closed-shop industries, selected private employment services, and the like. Still in the offing is the final and most drastic step, pulling men out of non-essential jobs and putting them in war jobs. This will have to wait for new legislation except as it is possible to a limited extent through the operation of the Selective Service System (see p. 412d).

STAMP PLAN ABANDONED

WASHINGTON — The much-heralded stamp plan for allocating machine tools which was to have gone into effect soon, has been abandoned, at least for the time being. Instead the priority system under which the machine tool industry has been working will be continued indefinitely. The numerical master preference list will still be the key to the top priority ratings. This list, however, may be revised more frequently than formerly perhaps on a monthly basis. No official explanation has been made as to why the new stamp plan has been discarded. It is believed that some of the plan's intricacies offered problems of administration which have not been satisfactorily solved.

PRP Use Furthered, Replacing Priority Ratings for All Firms

WASHINGTON—Pushing forward with its program of extending the use of the Production Requirements Plan until it becomes the normal way for all manufacturers to get their material requirements, the War Production Board is beginning to shut down on use of PD-1 priority ratings. Essence of PRP is that ratings are granted on limited and controllable amounts of materials. As more and more priority ratings are put on this basis, PRP approaches closer and closer to a real system of allocation.

The PD-1 ratings granted on individual orders by WPB, the similar PD-3 ratings issued by the Army and the Navy, and the blanket P orders granted to important industries are all open-ended orders. That is, once granted, there is no limit on the amount of material on which they may be used.

The P-orders are gradually being cancelled or allowed to expire. By July, there will be almost none left, and firms now using them will be under PRP.

Use of PD-1 Restricted

WPB has now decided that in a month or two it will stop issuing PD-1's for any goods to enter into production. Use will be restricted to minor items on capital equipment and similar non-recurring needs. Many manufacturers, in the past, who are able to get without ratings all the materials they need except one or two things, have used PD-1's to get these. When PD-1's are stopped, they will have to use PRP. Meanwhile, any PD-1's issued for material requirements in the next month or so will be closed-ended, will be limited to one month's requirements.

Preparations to put the hot-shot munitions industries themselves on PRP have in some cases encountered a certain amount of resistance from manufacturers who preferred their high-rated wide-open P orders. Aircraft manufacturers, however, when they were notified that they are soon to go on PRP, suggested that the scheme be tightened further, introducing a requirement that material needs be scheduled twelve months in advance rather than three as at present. This it is argued, would make it possible to anticipate and do something about shortages before they arise.

Pictures Help — Charts and pictures showing assembly procedure in detail have helped speed production at the Vega Aircraft Corp. plant. Girl here is putting together engine junction box for a flying fortress, following the instruction chart on the table

Canada Expands Metal Output For U. S.; Control Labor Use

OTTAWA—Canada has an important production expansion program in special war metals under way. It includes aluminum, magnesium, magnesium oxide and nickel. Most of the output will go to United States war plants.

Aluminum Co. of Canada, already supplying 43 percent of the North American output, is installing a big increase in manufacturing capacity. The entire increase is ear-marked for the U. S. This company is also bringing into production a plant for producing magnesium oxide from brucite deposits in Quebec.

In the last war magnesium production was started in Quebec but lapsed after the war. Dominion Magnesium Co. is building a big plant in Ontario to utilize dolomite ore in that province. It will use a process developed by Research Council of Canada, a federal government department. This production will also go to the U. S.

With nickel for steel alloys becoming tight, Canadian nickel interests are prepared to expand at the request of the U. S. and Canadian governments and development has been under way during the last 5 months in Northern Ontario for additional ore beds.

Power Shortage Imminent

The entire program, however, is faced with a prospective power shortage. To supply requirements of increased metal production power may have to be diverted from non-war industries. Some expansion of power development plants in Ontario and Quebec is proposed but cannot be completed in time to meet the new needs. The power supply depends in part on spring and summer rainfall. Power diversion from non-war to war industry probably would hit the pulp and paper industry first and the gold mining industry next.

Impending tightness of the power situation has been explained to Washington authorities in the last few days in connection with U. S. requests for the release of additional Canadian power to war plants in New York State.

To Open Priority Offices

As anticipated a month ago, Ottawa has cracked down on the private importation of gauges and cutting tools from the United States for profiteering purposes. Machine Tools Controller Thomas Arnold has issued an order prohibiting importation of such tools except under permit and requiring the applicant for a permit to supply detailed information as to his object in buying the tools. Despite a scarcity in gauges and cutting tools, some Canadian firms were buying them wherever available in the U. S. and offering them for indiscriminate sale at high profits in Canada. The orders stops the traffic. No tools or machines are exported from Canada except by permit.

Equality of treatment for Canadian companies with U. S. companies on Washington priorities has not cured the Canadian bottleneck in these priorities. Delays are constant through failure of Canadian companies to properly complete U. S. application forms before submitting them to the priorities division of Munitions and Supply Department at Ottawa. In an effort to speed up supplies of materials and equipment from the U. S. Munitions Minister Howe plans to open branch priority offices in principal war production centers across Canada.

Mobilize Manpower

Manpower in Canada will be frozen in its present employment preparatory to an orderly and progressive transfer of workers from non-essential to essential industry if this month's national plebiscite produces a substantial majority in favor of releasing the government from commitments restricting the sending of Canadian forces to military services overseas. A preponderant vote for freeing the government from these commitments will be accepted as a demand for complete national mobilization for total war and one of the first results will be a stiffening in manpower policy. An inventory is being established—from records of the unemployment insurance system and special war surveys—of all Canadian workers and will bar inventory serviceable workers from changing employment except under permit.

Compulsion will not be employed for the present in effecting transfer of workers from civilian to war production but the workers themselves and their employers will be placed under pressure to shift as the labor requirements of war industry increase.

OPA CUTS SMALL ARMS COST

WASHINGTON — Cost of small items of munitions manufactured in constantly increasing numbers are showing a tendency to decline, due to mass production. The Government still has time to keep a hard-bargaining eye on these details. One example is a cut of one cent per pound made by 13 firms producing brass for small arms, effective April 20.

It affects all cartridge case cups, bullet jacket cups and sheet metal required for these arms. Firms making the reduction turn out about 95 percent of brass materials for the war. The Office of Price Administration is studying a number of other munitions to find out whether the manufacturers can be asked to reduce prices. The brass reduction was requested by OPA Administrator Henderson in a letter to the producers.

Selective Service Change Puts Many Hardships on Employers

WASHINGTON—During the past year and a half most employers have got used to thinking of the Army draft as one of their personnel problems. But not all of them realize that since Pearl Harbor the whole philosophy of the selective service has changed and that the whole machinery is in a state of flux. Procedures which manufacturers have set up to keep a labor force together may have to be changed to correspond.

During peacetime the act was administered with the idea of causing as little inconvenience as possible, and deferments were granted freely. Now the underlying theory is that no deferment is granted except in order to forward the war effort.

Define Industries

A major distinction is now made between essential and non-essential industries. Essential industries fall into two groups: 1. Munitions manufacturers; 2. Those industries required to keep the country running, basic stuff like transportation, food, clothing. For the present it is up to individual draft boards to decide how a specific firm should be classified. Selective Service headquarters is getting ready to issue a series of advisory rulings as to the status of particular industries.

If your firm is an essential industry:

You can get temporary occupational (2-A and 2-B) deferments for some of your men who would otherwise be classified 1-A. To be eligible the employee must hold a job which is hard to fill because it requires special training, and the job must be such that your operations would be seriously handicapped if he left. Such a deferment is temporary and is intended to give you time to train a successor. The person you pick to train should be: a woman, a man over 45, a man with dependents. If the job is such that you just have to have a young fellow and you can't find one with dependents, you'll just have to resign yourself to a high turnover.

That is the situation. It may change at any time. Chairman McNutt of the new Manpower Commission has suggested the desirability of a blanket exemption for men in certain occupations (as distinct from industries). This has always been opposed by the Selective Service System.

As to your men with dependents, now classified 3-A. Draft boards will start in a few weeks breaking up the 3-A classification. Your employees, because you are in an essential industry, will be classified 3-B. This means they are likely never to be drafted.

But, if you are in a non-essential industry:

You are in trouble, and the only employees you can count on keeping are women and older men. None of your employees are eligible for deferment.

Converted Medium-Size Plants Supply Arms Which Will Make Up 'Margin of Victory'

BY A. W. JESSUP

ANOTHER SMALL EASTERN TOWN—The large bulk of America's arms will come from the nation's 50 or 60 large companies. BUT, the "margin of victory"—the numerical superiority in arms over the foe—will come from the medium-size firms which convert *totally* to manufacture munitions.

With production know-how, a wish to contribute to the Victory Program and confidence as their only assets, these companies are bearing an important share of our war load. There are some companies in this group, however, which have not joined in the production battle. They are needed desperately in the industrial ranks so that the "margin of victory" will be achieved by the year's end.

Why have they hesitated? They have the production know-how and they want to help win the war. What they have lacked is confidence. They have been afraid to tackle the completely new and exacting tasks of producing arms. They have been afraid to convert managerial skill, labor and plants.

Race Against Time

Certainly, the risks are great. Failure on a war contract could mean failure of the company. The roads to failure on a war contract aren't difficult to get on: The tolerances and production schedules are generally far more rigid than those of civilian operations. War production is not a competitive proposition. It runs against the clock, against the fine precision gages of government inspectors and against the rigid tests of Army and Navy proving grounds.

Great as the risks of failure in war production are, they are far overshadowed by the risks of losing the battle of production and losing the war. "It is better to try and to fail, than to do nothing", a manufacturer of electrical appliances decided several months ago.

After trying for several weeks to get war work similar to peacetime work, the company realized that all of this type had been contracted for. Resolved to do something and confident that it could, this firm went after a contract for fine precision bomb fuse mechanisms. It sold its production know-how to the Army and received an order for a fuse used in a bomb which is standardized for Army, Navy and British use.

Started From Scratch

That was last July. The first fuse was delivered in November. Production has been increased week by week, far ahead of original schedules. The company has outgrown its plant facilities. A next door factory has been leased; a new building is under construction in a neighboring plot.

In July, the firm started out with just the production know-how, its confidence and a desire to do something. Labor and management had to be trained in fuse manufacture, for fuses were an entirely new product unlike anything they had made before. Existing machinery was unsuited for the new manufacturing operations, so new equipment had to be purchased (old machines were sold).

Use Nucleus System

Management immediately set about learning all there was to know about fuse production. At the same time, a nucleus group of employees were taught the machine operations required, and some of each type of machine tool were purchased. As the first group became adept at their tasks, more employees and more machines were added. In this way the hardest task—training of personnel in skilled operations—was accomplished with relative ease.

Salesmen Enter Plant

Employees now total 400, three times the peacetime staff. Of these 50 percent are women. When present expansions are completed, women will probably make up three-quarters of the working force. They have been found equally satisfactory with men for all except screw machine operations. For assembly and inspection jobs they are better and much faster.

Faced with the breaking up of its nation-wide sales staff, the company offered plant jobs to salesmen. Many have accepted, usually at lower salaries. These men, of hign intelligence and adaptability, have become good machine tool operators in a short time.

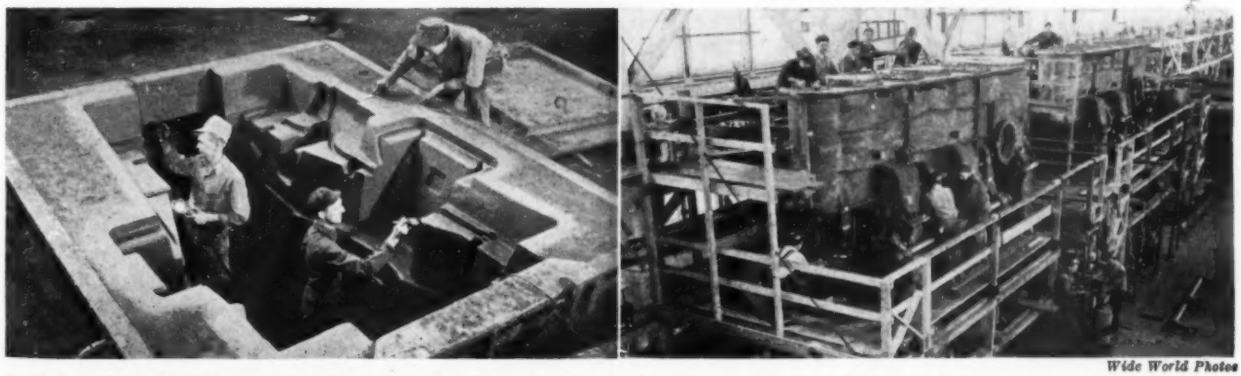
The operations required on the fuse which is made up of 84 steel and brass parts are screw machine work, milling, drilling, punch press work, plating and assembling. There is also a great deal of tool making required.

Halted Civil Work

Parts are subcontracted to a dozen outside shops. At first most of these did not want to touch it, preferring to stay out of war work. Some of the parts which were first figured to be subcontracted have been too difficult for subcontractors, and it became necessary for the prime contractor to take over. This naturally added an additional burden and revised manufacturing plans.

Long before the War Production Board stopped all production of the peacetime products of this firm, it had asked that it be allowed to assign its quotas and material allotments to another manufacturer. This made way for total use of all manufacturing space and all personnel on war work.

Peacetime volume of business was around $1,000,000. War business is now at the rate of $3,000,000.



Wide World Photos

Engines for Ducklings—Engines for the fleet of "ugly ducklings", EC-2 freighters, that are carrying U. S. tanks, planes and arms to the world's battlefronts, are being manufactured in the converted plant of the Joshua Hendy Iron Works. The engines are built from below ground up. Molten iron is first poured into a mold dug one-story deep (left). The completed 2,500 hp. engine towers 3 stories high on this base (right)

WPB Halts Machinery Output To Force More Conversion

WASHINGTON—Forced conversion of industry to war by forbidding civilian production has proceeded farthest as regards producers of civilian goods. This month it moved into the field of industries supplying the civilian industries with issuance of an order forbidding manufacture or delivery of a long list of industrial machinery except with War Production Board approval. The machinery affected is that used by suppliers of civilians and the order is designed not only to ration such machinery to the places it is needed most but also to reduce the amount of such machinery built and force the builders to convert to war work.

Under the order L-83, deliveries may only be made on orders placed by Federal war agencies or the Lend-Lease governments, or on orders accompanied by an A-9 or better rating evidenced by a PD-1a or P-19h certificate or a PD-3 or 3A certificate countersigned before April 9. Manufacturers of affected machinery may apply to WPB for permission to fill orders now on their books.

Used and reconditioned machinery are also covered by the order.

The order covers all types of machinery for leather working, tanning, textile fabrication, cotton ginning and delinting, and shoe manufacturing and repairing. It includes machines costing more than $200 for paper converting, printing and publishing, baking, confectionery making, beverage bottling, and industrial sewing. Pulp and papermaking machines costing more than $1,000 are covered.

Deliveries of $1,000 worth of parts for the repair or maintenance of any existing machine are permitted, or any amount of parts may be delivered to repair a breakdown.

For Valiant Service—A Navy "E" pennant in recognition of outstanding service to the U. S. Navy on the production front was presented to the Cincinnati Milling Machine Co. recently. Rear Admiral Clark H. Woodard (left) is making the presentation to Frederick V. Geier, president

CONTROLS TOOL STEEL IMPORTS

OTTAWA—Canadian industry cannot import high speed steel, carbon tool steel or alloy tool steel from the United States except by license under an order approved last week by the Wartime Industries Control Board. The order springs from a developing shortage of alloys needed for cutting tools.

Production Veterans—Almost 6,000 Allis-Chalmers employees have been with the company at least ten years, 41 more than 50 years. Recently diamond studded emblems were presented to the half-century workers. Auguste Werner (left) is getting his from Vice President William Watson (right), also a 50 year man, while James White, works manager looks on

Ship Assembly Line Takes Shape; Crews Repeat Jobs

WASHINGTON — Unofficial information indicates that the Higgins ship assembly line near New Orleans is really a phenomenal development. Informed persons tell American Machinist that the keel and initial rib and hull structure move on rail-borne trucks. Along the assembly line are strung cranes, shops, crews and stores of parts.

At the end of the rail line, the ship has sufficient bottom to float. It continues moving in the water between two piers of additional assembly facilities, according to the report. It is said the piers will be several miles long. Engines, boilers and other elements are put in as the ship moves along the water way, and it comes out at the end with steam up.

Assembly crews doing exactly the same job over and over are faster than men moving from beginning to end of a ship job. Parts and subassemblies for these Liberty ships come from all sections of the country. This kind of shipbuilding will have little use in peacetime but, if it works out, it will be a wartime lesson to the Axis and all who come after them.

MOREY DELIVERS 100th SHAPER

NEW YORK—The one hundredth vertical shaper manufactured by the Morey Machinery Co. was turned over to the Army Ordnance Department last fortnight. Formerly a rebuilder of machine tools, the company began building new machines in 1939. Captain Donald B. MacMaster represented the Ordnance Department and the presentation was made by Company President Sigmund Morey.

INSIDE DETROIT

SAE expands War Engineering Board to give more service to War Department, WPB, Automotive Council. Studies solve many materials problems. Auto firms "sold" $266,000,000 worth of arms in Feb.

BY RUPERT LEGRAND, DETROIT EDITOR

DETROIT—One of the major contributions of the automobile industry to the war effort is that of engineering skill. To the popular mind, the "assembly line" is Detroit's answer to the Axis, and certainly the production "know how" and vast retooled resources of the industry will play an important role in supplying the armed services with superior materiel. The automotive engineer is the pioneer in respect to these activities, since upon his shoulders falls the responsibility for solving problems prior to and during production and for designing the "new models" that will perform effective service in all parts of the globe.

Application of horsepower is the root of mechanized war. America fortunately possesses a wide margin of superiority over its enemies in reserves of engineering skill familiar with the problems of applying internal combustion engines to mass-production products. Concerted use of this knowledge has already been made effectively under the auspices of the Society of Automotive Engineers' War Engineering Board.

Increase Engineering Board

Membership of the Board has been increased to cope with expanding use of its services by War Department engineers, the War Production Board and the Automotive Council for War Production. Original members of the board, under the chairmanship of J. C. Zeder, chief engineer of Chrysler Corporation, are: B. B. Bachman, vice-president and chief engineer, Autocar Co.; J. M. Crawford, chief engineer, Chevrolet Division, General Motors; R. E. Cole, vice-president of engineering, Studebaker Corp.; F. F. Kishline, chief engineer, Nash-Kelvinator Corp.; R. H. McCarroll, Ford Motor Co.; and D. G. Roos, vice-president and chief engineer, Willys-Overland Motors, Inc.

The new members are: L. R. Buckendale, vice-president and chief engineer, Timken-Detroit Axle Co.; Arthur Nutt, vice-president in charge of engineering, Wright Aeronautical Corp.; Don Berlin, aircraft engineer, General Motors; C. G. A. Rosen, director of research, Caterpillar Tractor Co.; Ralph R. Teetor, vice-president, Perfect Circle Piston Ring Co.; and Earl H. Smith, executive engineer, Aircraft Engine Div., Packard Motor Co.

400 Conduct Projects

Important projects now being undertaken for the Army Ordnance Dept. and Quartermaster's Corps include study of critical materials in motor vehicle equipment and armored vehicles. This study is being carried out by board members working through sub-committees made up of leading metallurgists, research men and designers from every interested branch of the industry. More than 400 engineers are engaged on war engineering board projects. These men have at their disposal the combined research and engineering facilities of the companies they represent.

The method of compiling reports streamlines time required, provides complete information from all recognized authorities who have information related to the problem posed by the government agency. The board assigns the topic to a member, who acts as chairman of a sub-committee. He may call upon as many as 40 experts throughout the automotive and related industries to assemble data on all phases of the problem. In sub-committee meetings, data and opinions are correlated, a report made to the Board. After review, the Board takes the report to the requesting authority, offers any explanation that may be asked.

Facilitate Substitution

Promptness in preparation of detailed studies—two to four weeks ordinarily—has won the appreciation of hard-pressed government engineers and executives. Through the spirit of teamplay already developed, vexing problems of materials substitution are being solved much more rapidly than without close cooperation. For example, most mechanized equipment was designed under peacetime conditions when there was no thought of materials shortages.

In reviewing specifications for component parts of a mechanism, points are discovered where materials are no longer available in quantities sufficient to maintain production quotas, or where the original specification provides too ample a margin of safety or service life compared to the whole. War Department engineers and automotive experts have cooperated in some instances to rewrite entire materials lists. The former recognize the wide experience of their colleagues in finding satisfactory substitutes and carrying out production and service tests without delay.

Will Use Available Metals

To speed the war effort still further, the day is approaching when recognized authorities in industry may be allowed to use whatever materials are available, so long as physical properties desired by the military are met or exceeded. In other words, military engineers must retain authority in respect to ballistics, but their supporters in industry will be free to employ any means at their disposal to expedite production within the limits of physical properties and service life required on revised government drawings and specifications.

The SAE War Engineering Board has also completed several consulting projects for the War Production Board. Most recent of these was a survey of copper in replacement automobile parts. The survey, which was requested by the Replacement Parts Section of WPB, is being used as a guide in preparing a new order governing the uses of copper. Spokesmen for the project believe that nearly 40 percent less copper will be required in the replacement parts manufactured for automobiles this year. Similar studies and reports have been made on crude, reclaimed and synthetic rubber. Other studies now in progress for WPB include chromium, nickel, tungsten, tin and cork.

To save copper on replacement parts, passenger-car radiators may be made with copper tubes and steel fins, sav-

Jigging for Tanks—Back in the days of automobile production, jigs and fixtures aided mass production by standardizing each job. The jig technique is now being applied to tanks. Fisher Body craftsmen are building a fixture for a tank turret (left)

ing from 30-50 percent of the red metal ordinarily employed. Radiators for military vehicles operate at peak capacity, which means that the construction mentioned is not suitable unless other major design changes can be accomplished in the vehicle. Copper can be eliminated from numerous other passenger-car replacement parts: fittings, couplings, drain plugs, grease cups, air cleaner fittings and elements, carburetor parts.

To chart progress of the automobile industry on war production, the Automotive Section of WPB plans to issue statistics on monthly "sales" compared to the ultimate capacity rate. Figures for February, on 180 companies representing 85 percent of the industry (based on labor) disclose that assigned war production had reached an ultimate capacity rate of fourteen billions annually and that February operations had reached 22.5 percent of that pace. In other words, "sales" of armament in February, as reported by seven auto firms, 25 truck makers and 148 parts producers amounted to $266,000,000, or 27 percent as much as the industry produced in the entire year of 1941.

Work Half of Cost

Since one armament producer may sell to another in the group, the sales figures contain some duplications. "Value-added" figures, reached by subtracting from total sales the costs of raw materials and parts supplied by subcontractors, show that one-half the cost of armament to be sold under the ultimate capacity rate of fourteen billions annually will represent work done by the 180 automotive firms. In February, value-added war production amounted to $136,000,000, or 23 percent of the maximum anticipated war load.

In 1941, the peak production month of the automotive industry, as measured by sales, was $800,500,000, or better than the rate of nine and one-half billions yearly. Employment in that peak 1941 month was 759,610. Production man-hours in that same month were at the rate of just over one billion a year. Maximum employment on war production, based on orders on hand in February, will be 929,000, and production man hours will reach more than one and one-half billion.

Cutting Tools Scarce

Jig and fixture work for auto plant retooling on the whole is coming along satisfactorily. Large numbers of skilled die and fixture men are currently being released to other work, as major activities like bomber tooling near the completion stage, except for duplicates. Chief problem ahead is that of providing cutting tools in adequate quantity and reasonable delivery. Months ago, delivery of many types of cutting tools took six months; by May 15, delivery time will probably increase to nine months.

The proposal to form a pool for production of cutting tools (*AM*, Vol. 86, page 354g) has been dropped. Present thought leans toward further expansion of the existing, recognized tool plants which have adequate job knowledge, and assistance to perhaps 50 or 100 smaller plants who have demonstrated that they can make tools.

Many of the tool problems that will arise from now on are concerned with the manufacture of special or new forms of tools by which auto plants hope to speed production of armament and improve quality. War contractors and vendors are pushing tool development with the result that new forms and new types of tools face production bottlenecks.

WPB Cracks Bottlenecks

Later it was found that a new design of thread mill would increase production another 25 percent and produce 75 percent more work between grinds. Necessary machine attachments to produce thread mills of the new style could not be received before December under existing priorities. WPB took steps on the matter, with the result that the patent holder furnished drawings for the attachment, which will be built locally.

Bottlenecks in tool supply are being overcome by WPB through special attention to the "critical tools". Forty-four such cases were handled for one company in two weeks. In another case, an aircraft engine manufacturer needed special drills, which in the course of events would be delivered in 60 days. The situation was explained to a drill manufacturer, he was given authority to slip the order into the existing priority set up, and the drills were furnished in two days.

WAR ORDERS IN BRIEF

STEEL PRODUCTS—Deliveries of iron and steel products is restricted to preference ratings of A-QP or higher after May 15. (Amendment 1 to Preference Order M-21).

NICKEL SCRAP—Scrap containing more than ½ percent nickel must be segregated and can be melted only for authorized uses. (Supplementary Order M-6-c).

STOVES—Gas cooking stoves are subject to limitation order L-79 and cannot be sold except on A-10 or higher priority.

MACHINERY—Production of industrial machinery in many classes will stop May 15. Deliveries cannot be made or orders accepted except with War Production Board approval. Production is allowed to continue on orders received prior to April 9. (Limitation Order L-83 and Amendment 1).

COMPRESSORS—Heavy compressors are under a system of complete WPB allocation. (Limitation Order L-100).

FARM EQUIPMENT—An A-1-a priority rating has been granted to manufacturers of certain types of farm equipment and machinery. (Amendment 2 to Preference Order P-95).

BURNERS, STOKERS — Manufacture of residential oil burners and coal stokers is prohibited after May 31, and production of commercial and industrial types is limited to orders with a preference rating of A-10 or better. (Limitation Order L-74).

FURNACES—Iron and steel used in warm-air furnaces has been sharply reduced. (Limitation Order L-22).

STEEL MAKERS—A preference rating of A-1-c has been granted on 30 percent of the value of repair, maintenance and operating supplies ordered in one quarter by steel producers. An A-3 rating covers the remainder. (Amendment 3 to Preference Order P-68).

ELECTRICAL APPLIANCES — A further reduction has been made in quantity of electrical appliances that can be produced prior to May 31. (Amendment 1 to Limitation Order L-65).

PRIORITIES—All applications for priority assistance must contain a specified delivery date.

MINING MACHINERY — Deliveries of mining equipment and machinery can be made to South American copper companies operating under Preference Order P-58, to iron and steel producers under P-68 and to smelters under P-73. (Amendment 2 to Preference Order P-56-a).

LAUNDRY EQUIPMENT—Production of commercial laundry equipment must halt June 1, and of dry cleaning equipment July 1 except on Army, Navy and Maritime Commission orders. (Limitation Order L-91).

GENERATORS, BOILERS—Sales of used stationary steam turbine generators and steam boilers is prohibited except with WPB approval. (Limitation Order L-102).

FARM MACHINERY—Sales of farm machinery and equipment in excess of quantities permitted to be manufactured. (Amendment 2 to Limitation Order L-26).

FIRE APPARATUS—Use of rubber tires on auxiliary trailers for fire apparatus is prohibited. Steel rimmed wheels will be satisfactory according to WPB. (Amendment 1 to Limitation Order L-43). Preference rating orders P-45 and P-108 covering material used for motorized fire apparatus and fire protective equipment have been extended until June 30.

AUTOMATIC PHONOGRAPHS — Copper wire cut before March 16 can be used in automatic phonographs, weighing and amusement machines. Sale, transfer and delivery of repair parts is allowed. (Interpretation 1 of Limitation Order L-21-a).

GEARS—Manufacturers of gears, pinions, sprockets and speed reducers whose gross sales in 1941 were under $5,000 need not submit monthly reports to the Office of Price Administration. (Amendment 1 to Price Schedule 105).

TIN—Limitations on use of tin in the manufacture of war products has been removed, war products being defined as combat end products. (Amendment 1 to Preference Order M-43).

WARTIME WASHINGTON

Rise of 70 percent in U. S. plane output paces United Nations to big lead over Axis. Domestic output of all arms doubled in 5 months, but lack of ships limit use. Enemy patents taken by President

BY BLAINE STUBBLEFIELD

WASHINGTON — Aircraft production in this country has now exceeded a rate of 3,300 planes a month. This is an increase of about 70 percent during the five months since the last official figure—1,914 in September. This figure supports recent semi-official statements that United States plane production now exceeds that of the entire Axis. Best estimates of German production run to about 2,500 a month, Japanese 300–400, Italy and France, not more than another 300–400. British officials say that their production is equal to the German. Together with a Russian production estimated in the neighborhood of 2,000 this means that plane production by the United Nations is now more than twice as great as Axis output.

No similar figures are available on other types of armament. However, in the same period in which aircraft production rose 70 percent, total U. S. expenditure for war more than doubled—rising from about $1,300,000,000 in September to $3,000,000,000 in March. This indicates that aircraft figures are fairly typical of the armament effort as a whole. We have definitely entered the mass production period, and expectations that 1942 would be a year of vast and unparalleled munitions production are being fulfilled.

Ships Biggest Headache

This situation is the reason that you are hearing more and more complaints about ship building. The rise in arms production coupled with the fact we are fighting at great distances from our shores means that we can now build the stuff faster than we can haul it away. Shipping thus becomes the biggest bottleneck.

You can expect the next big drive to be aimed at shipbuilding—perhaps involving types which will conserve the limited supply of steel plate. Rumblings in Washington indicate that, justly or unjustly, Admiral Emory Land will be coming under heavy fire. Someone else may get his job.

Investigation Leads to Seizure

All you read in the papers about patents and monopolies and collusive international dealings hampering our war effort, boils down to just two facts: (1) President Roosevelt, using executive war powers, has seized all patents controlled directly or indirectly by enemy nations; (2) there is a bill before congress which, if enacted, will authorize the President to seize any and all foreign and domestic patents, licenses and inventions and to grant anybody licenses under them and to prescribe the royalty to the patent owners.

The President's seizure of all enemy patents came as a result of sensational revelations currently made by a Senate Patent Committee investigation, and of previous Truman Committee publication of trustbuster Thurman Arnold's charges that Standard Oil of N. J. had throttled development of synthetic rubber in collusion with German companies. Purpose of the Senate inquisition was to show that patent monopolies are hampering war production, and to push legislation as a remedy. Whether intended or not, it helped in bringing summary action by the Chief Executive.

Arnold Prepares List

Actually, the President has instructed his Alien Property Custodian Leo Crowley to take over the enemy patents that will serve our war need.

Mr. Crowley will be guided as to which enemy patents he will seize by a survey already made by Mr. Arnold, chief of the antitrust division of the Department of Justice. Crowley may take control of an entire company operating on enemy patent rights, or he may simply take possession of patents.

It will not be the custodian's invariable policy to make enemy patents available to U. S. industry if products covered by such patents are already in satisfactory production under our own similar patents.

After the last war, German patents which we had seized were returned to their owners, and Germany has been making economic war against us with the same and other patents for years. The President wants to make sure that the patents we are seizing now are not returned to Germany after the war, but he may have no control over that—unless he is President at that time. This matter will be subject to treaty negotiation.

Seizure Superfluous Act

Since a patent is valuable property, like a ship or a warplane, you may wonder why we have waited so long—why didn't we grab the patents as quickly as we grabbed the enemy ships? The answer is that we have broken all the German patents we wanted, already. Production under them is already under way. Seizure of the patents by the Chief Executive was mainly a gesture under the spotlight thrown on the situation by the Senate investigation, as we have already said.

Although the immediate war-patent situation is met by the President's action, and by previous cards played under the table, the Senate Patent Committee will go ahead with its study and some sort of bill will be proposed.

Acme Photo

Jeep of All Tricks—One of the most versatile of the U. S. Army's motorized vehicles is the jeep. The latest model turned out is the answer to the search for an amphibian cat. This water-bug jeep swims along at 10 m.p.h. (above). On land it retains all the performance points of its predecessors. Production has been started on a large order

JOHNSON ASKS BUILDERS TO WORK 168-HOUR WEEK

Tells Association more and more machine tools are needed, predicts employment of women. PRP explained by Tell Berna

CHICAGO—"The machine tool industry is today a division of the fighting forces of the United States. We are fighting, in our own way, the battle of America . . . We must make more machine tools, more than we ever dreamed of before, just as fast as we can. That is our program for 1942."

So stated George H. Johnson, president of the Gisholt Machine Co. and president of the National Machine Tool Builders' Association, at the fortieth spring meeting of the association last fortnight here. The meeting was devoted entirely to a discussion of the war problems facing the industry. It consisted of two morning sessions and the usual group meetings in the afternoon and evening of the first day. Attendance was close to an all-time record.

Mr. Johnson reported in detail on the problems of production, material and manpower. He said that practically every machine tool builder is now converting operations to a basis of 24 hr. a day, seven days a week. Many difficulties are involved, but, remarked Mr. Johnson, "all of the reasons which any of us might bring forward to explain why some of our machines are idle eight hours out of 24, or on Sundays, would seem pitiful to an American private helping to hold Corregidor."

Alloy Use Limited

If output is limited by operation of critical machines, Mr. Johnson suggested that production may be brought into balance by subcontracting work which you cannot do in your own plant. In case you have facilities which cannot be used around the clock in your own work, turn them to subcontracting for some other machine tool builder.

All of the engineering and designing skill at the command of each company must be used to develop substitutes for critical materials, urged Mr. Johnson. He pointed out that the request of the War Production Board for builders to stop using nickel in castings was only a forerunner of drastic reductions of all vital alloy metals such as nickel, vanadium, tungsten, molybdenum, chromium and manganese in products not employed directly by the armed forces. Excellent results already have been obtained in cutting down the consumption of aluminum.

The situation in manpower is such, declared Mr. Johnson, that the industry must be prepared to employ and train men who are not likely to be called and also to employ women. He said, "We are told that in England and Canada as high as 60 percent of machine operators in factories are women. The chief engineer of our company recently returned from inspecting Canadian munitions plants and told me that women were operating planers and boring mills."

G. H. JOHNSON

Seek Special Classing

Mr. Johnson recorded his "firm opinion that before this war is over, most of us will employ large numbers of women; and we will be particularly grateful to our designers and engineers who, over the last 10 years, have contrived to plan machine tools in such a way that their operation involves the use of push buttons and easily handled levers rather than the exercise of muscle."

As against what the industry has done and must do, Mr. Johnson cited some handicaps from which machine tool builders should be freed. One consists of entanglements arising from an excess of zeal in Washington and from an accumulation of red tape. Another is the flood of questionnaires which builders are asked to fill out. Still another is the proposed change in rating for materials from blanket priority P-11-a to the Production Requirements Plan and the allocation of materials under PD-25-a. Instead of being classed with all of industry, the machine tool builder should be considered separately, since his product comes first in the war production effort, in the opinion of Mr. Johnson.

Government Has Helped

In conclusion, Mr. Johnson said, "Remember that, along with governmental investigation and regulation and red tape, have come governmental financing of pool orders and governmental cooperation with respect to many phases of our business. Bear in mind that in this whole situation the major objectives of our industry and the major objectives of the government are identical. Such differences, therefore, as arise today are differences in method. Let's take whatever we must take as the fortunes of war."

In his report as general manager of the association, Tell Berna described in detail the procedure to be followed by machine tool builders in purchasing materials under the Production Requirements Plan (PD-25-a) effective July 1. The new plan is intended to correct the present situation which permits the purchase under a high blanket rating of scarce materials, although only a few of the orders for which the materials are intended may have a high rating. It is also intended to control inventory and prevent the hoarding of scarce materials.

Ratings Set for July 1

The plan will not affect the purchase of capital equipment for which a PD-1-a application will still be used, or plant expansion under PD-200. It apparently will not affect the reports now required by the Materials Section on such materials as copper, nickel, rubber and steel, although the information asked for by PD-25-a duplicates them to a large extent.

Builders will be requested to report on or before June 15, said Mr. Berna, so that priority ratings may be assigned them by July 1. To arrive at the proper priority decisions, the Division of Industry Operation asks for a breakdown of customers' orders and shipments by priorities. The data on shipments applies to the most recent three months (March, April and May). Total shipments in units and dollars for the second quarter will be required, though of necessity part of it must be estimated. Shipments also must be classified by end use (Army, Navy, Maritime Commission, etc.).

Will Authorize Purchases

To check excessive inventories, builders are asked to report, as of Jan. 1 and April 1, the total value in dollars of raw materials, work in process, finished machines and supplies. Perhaps the most important part of the survey is to report the amount in stock at the beginning of the quarter, amount received during the quarter, amount used, inventory on hand at end of this period and anticipated requirements, for each item of material shown in the list attached to PD-25-a. The same information should be given for any unlisted items on which priority assistance is needed in purchasing. A report of total inventory of maintenance, repair and operating supplies is sought.

When all of this information has been submitted, the Priorities Division will authorize the purchase of the materials needed by the builder during the next quarter. If customers' orders vary as to priority standing, the builder may buy 200 units, of say castings,

on A-1-a, 100 on A-1-j and 50 on a rating of A-2.

At the beginning of the plan, said Mr. Berna, there is nothing to prevent the machine tool builder from buying, under blanket P-11-a priority before June 30, the materials needed for customers' orders or pool orders on hand extending to the end of the year or beyond, provided that required dates are in line with actual needs and the inventory on hand is not allowed to become excessive in proportion to use. This fact will not eliminate the need for reporting on PD-25-a, nor curtail in any detail the records that must be kept, but it does allow the placing of orders at the builders' present high rating and does not put some of them down in the A-2 class.

Mr. Berna emphasized the seriousness of the situation created by the order from Washington to eliminate use of nickel steel in machine tools. Only a nine-day period of grace was allowed the builder to find satisfactory substitutes.

Industry Praised

War production is up to expectations, but the United Nations need more and more of everything, said William H. Harrison, director of the Production Division of WPB, in addressing the members. The machine tool industry has done a fine job, he declared, but machine tools still are the limiting factor in the worst required items. He made a plea for cooperation in the substitution of materials.

Frida F. Selbert, secretary of the association, and Ralph E. Flanders, president of the Jones & Lamson Machine Co., spoke at the executive session on the first day of the meeting. The speakers at the executive seseion on the second day were George C. Brainard, Chief of the Tools Branch of WPB; Geoffrey W. Smith, counsel for WPB; and Howard W. Dunbar, vice-president of the Norton Co. and Assistant Chief of the Tools Branch of WPB.

EXPAND PLATING LABORATORY

MATAWAN—The plating laboratories of Hanson-Van Winkle-Munning Co. have been reconditioned and enlarged to provide facilities for the increased volume of research and experimental work brought on by the war effort. The polishing room has been rebuilt and equipped with new machines. Provision has been made for semi-commercial plating tests.

LECTURES ON GAGING METHODS

DAYTON—A series of lectures to university and defense training classes on "Gaging Practices in Modern Industry" are being delivered by Louis Lingler of the Sheffield Corp. The lectures are designed to give the student information on precision gages and gaging methods.

Tone Succeeded as President Of Carborundum by Batts

NIAGARA FALLS—Dr. Frank J. Tone, who has been with the Carborundum Co. since 1895, retired as president last week. He was appointed to the new

DR. F. J. TONE

position of chairman of the board of directors. Arthur A. Batts, formerly secretary, succeeds Dr. Tone.

The retirement of Frank H. Manley, treasurer, was also announced. Thomas B. Foote, his assistant, becomes treasurer. Vice president Henry P. Kirchner was elected executive vice president in charge of operations. Mr. Batts successor as secretary is Frank A. Vokrodt. Frank J. Tone, Jr., was elected a vice president. He was a sales executive.

PASS PROFIT LEGISLATION

WASHINGTON—An ambiguous piece of legislation to limit war profits was passed by Congress last week and sent to the President attached as a rider to the Army-Navy supplemental appropriation bill for $19,151,597,000. In effect it provides no formula, leaves determination of profit-fixing policy to the Army, Navy and the Maritime Commission.

Renegotiation of contracts, using as a base profit limits set up by the services, is the medium for fixing profits. In the law are penalties for falsification of production costs, a method already being utilized by the contracting agencies.

The bill, however, did contain instruments of persuasion through priorities controls, contract cancellations and assignments or distributions of production. In a sense, these are superfluous as the services are using them anyway to keep profits down and war costs low; the Army, Navy and Maritime Commission fear post-war congressional investigations and that thought alone is sufficient for most businessmen.

In fact many companies have offered to refund profits in excess of expectations.

NAMES in the NEWS

William E. Boeing, founder, the Boeing Aircraft Co., has offered his services for the duration of the war to the company. Mr. Boeing, who retired from the chairmanship of the company eight years ago, will act in an advisory capacity.

Stanley Bracken and David Levinger have been elected vice presidents, Western Electric Co. Mr. Bracken, who is general manager of manufacture, joined the company's Hawthorne Works in 1912. Mr. Levinger is manager of the Hawthorne Works.

Wallace K. Brown has been appointed vice president in charge of procurement, Crocker-Wheeler Electric Manufacturing Co. He had been general sales manager.

W. C. Buchanan has resigned as president of Allis-Chalmers Mfg. Co. He will continue to serve on the company's board of directors and executive committee. No successor as president has been named. Walter Geist, formerly vice president, has been elected executive vice president. He has been with the company since 1909.

Fred W. Cederleaf, formerly works manager, Dodge Manufacturing Corp., has been named plant manager of the two Detroit plants of the Republic Aircraft Products Division, the Aviation Corp. Prior to joining the Dodge Corp. three years ago, Mr. Cederleaf was manager of the machinery division, Ex-Cell-O Corp. He has also been connected with the General Motors Corp. as consulting engineer, A-C Spark Plug Division, assistant works manager, Olds Motor Works, works manager, Muncie Products Division, and manufacturing research manager, Buick Motor Division.

Warren H. Clarke, who had been Michigan State Director, War Production Board, has been appointed assistant general manager, Houde Engineering Division, Houdaille-Hershey Corp. He succeeds the late Frank R. Schubert.

Harold I. Crow, executive vice president, has been elected president, Air Associates, Inc., succeeding Frederick G. Coburn. Mr. Crow who was elected executive vice president in 1938, has been with the company 13 years. Mr. Coburn became president last November following a period during which the U. S. Army operated the plant during labor difficulties.

H. E. Doughty, formerly a district manager, has been appointed assistant sales manager, Jessop Steel Co.

James K. Fulks has been appointed vice president in charge of manufacturing, Ex-Cell-O Corp. Since Novem-

Manufacturing Chief

J. K. FULKS

Tank Maker

A. M. HAMILTON

Heads Tool Sales

C. W. KRUEGER

ber 1940, he had been factory manager in charge of all the company's plants. He joined the company in 1925 and has been connected with all phases of the company's production of precision machine tools and parts.

Alexander M. Hamilton has been elected executive vice president in control of the Canadian Tank Arsenal which is operated by the Montreal Locomotive Works, an affiliate of the American Locomotive Co. He joined the American Locomotive Co. in 1910 and spent several years in various posts relating to the company's foreign business. He served as technical representative in Russia, was European representative after World War I, and later served as head of the company's foreign business.

J. A. Krugler, general sales manager, has been promoted to vice president in charge of sales and purchases, Taylor-Wharton Iron & Steel Co. J. L. Lonergan has been appointed superintendent of the Easton, Pa., plant.

Clarence W. Krueger has been appointed sales manager, Whitman & Barnes, division of the United Drill & Tool Corp. Mr. Krueger had been manager of the New York sales office.

H. C. Madsen has been appointed manager, technical employment and training, Westinghouse Electric & Mfg. Co., succeeding Major J. H. Belknap. Mr. Madsen served in the time study department of the Switchgear Division and in the company's Industrial Relations Department. Major Belknap recently entered the Army Air Service as a member of the board in charge of recruitment and placement of young officers.

I. S. McReavy, formerly manager, tool division, Ingersoll Milling Machine Co., has joined the Crucible Steel Co. as manager, Rexall Division. Mr. McReavy had been with the Ingersoll company for eleven years. His new headquarters will be in Detroit.

George A. Meyrer and Mundy I. Peale have been elected vice presidents, Republic Aviation Corp. Mr. Meyrer was facilities manager at the company's plant and Mr. Peale had been director of military contracts.

Perry V. Ogden has been appointed factory manager and general superintendent of the manufacturing division, Boeing Aircraft Co. Mr. Ogden will supervise the production department and production shops of the Seattle plant. He had been production chief for the company from 1928 to 1934, leaving to become production control supervisor, Consolidated Aircraft Corp.

David F. Robinson, a district sales manager, Wm. Sellers & Co., Inc., is on leave of absence to serve in the Bureau of Aeronautics, U. S. Navy.

OBITUARIES

Henry R. Carse, 76, president of the Electric Boat Co., died recently in New Rochelle, N. Y. Mr. Carse became president of the Submarine Boat Corp. in 1915, and retained that position when the corporation became the Electric Boat Co.

S. Forry Laucks, 72, president, York Safe & Lock Co., died recently in Wrightsville, Pa. Mr. Laucks served with the company since 1887. He gained nationwide fame during America's war preparedness program as the founder of the York plan under which his company and others in the York, Pa., area converted to war production.

Mead W. Paterson, assistant works manager, Bridgeport Brass Co., died recently in Bridgeport.

Fred J. Maeurer, a specialist in the applied engineering department, Air Reduction Sales Co., died recently. He first became associated with the oxy-acetylene industry in 1909 with the Davis-Bournonville Co. In 1922 this

FRED J. MAEURER

firm was acquired by Air Reduction. While with Davis-Bournonville, Mr. Maeurer was superintendent of the welding shop at Jersey City and for a number of years was a service engineer in Chicago.

Charles E. Reinel, 66, a plant manager, Allis-Chalmers Manufacturing Co., died recently in Madison, Wis. He joined the company in 1896.

MEETINGS

American Gear Manufacturers Association. Annual Convention. Hotel Hershey, Hershey, Pa. May 11-13.

American Iron & Steel Institute, General Meeting. Waldorf-Astoria, New York, N. Y. May 21.

American Management Association. Production Conference. Hotel Astor, New York, N. Y. May 13-14.

American Management Association. General management conference. Pennsylvania Hotel, New York, N. Y. June 5.

National Electrical Manufacturers Association. Annual Meeting. The Homestead, Hot Springs, Va. May 10-16.

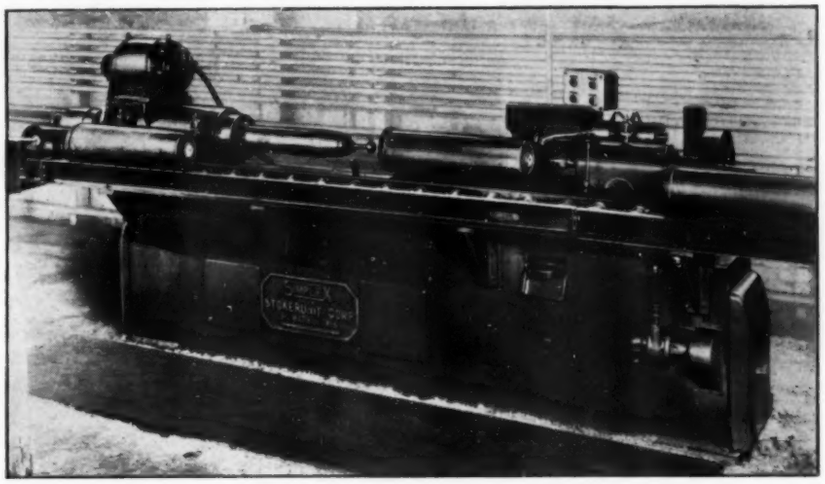
National Metal Trades Association. Annual Convention. The Biltmore, New York, N. Y. May 19-20.

Society for the Advancement of Management. Semi-Annual Meeting. Hotel Gibson, Cincinnati, Ohio. May 7-9.

Society of Automotive Engineers, Annual summer meeting. The Greenbrier, White Sulphur Springs, W. Va. May 31-June 5.

SHOP EQUIPMENT NEWS

Stokerunit Centering Machine Designed For Automatic Cycles on Large Size Shell



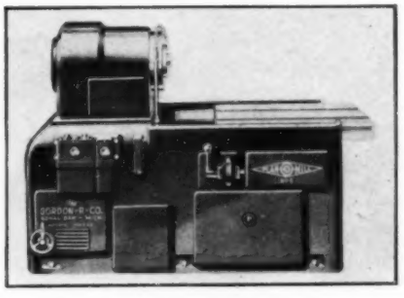
Centering machines for 90, 105 and 155 mm. shell that will fit directly into the conveyor lines have been introduced by Stokerunit Corp., 4548 W. Mitchell St., Milwaukee, Wis. Shell can be centered and returned to the conveyor in 30 sec. All that the operator has to do is to roll the shell from conveyor to work tray, push the starting button for the automatic cycle, and one-half minute later he rolls the shell back onto the conveyor. Work cycle stops automatically. As there is no lifting, the work is light even with 155 mm. or 6 in. shell which weigh between 130 and 160 lb.

The automatic cycle is started by pressing the starting button. Cycle advances table, forces the mandrel into the shell against a spring-loaded stop, expands the mandrel to hold the shell firmly, drops the work tray and starts the mandrel and centering tools revolving in opposite direction. This tool advances, drills the center and retracts. Mandrel releases the shell, the table returns, and the work tray comes out to receive the centered shell. These machines are installed into the conveyor lines which brings the forged shell bodies to the lathes for the first machining. Brackets on the side of the machine provide a support for the conveyor track.

Successive Operations Performed in One Cycle With Gordon-R Company's Plan-O-Mill

Planetary milling is augmented with the flexibility of hydraulic operation on the No. 5 hydraulic Plan-O-Mill, announced by the Gorden-R Company, Royal Oak, Mich. Hydraulic motors on the spindle and quills permit the operator a choice of feeds and speeds by merely adjusting dials. No gears or sheaves need to be changed, and the only other adjustment necessary is the lead screw on the spindle. Hydraulic operation of the table is also provided.

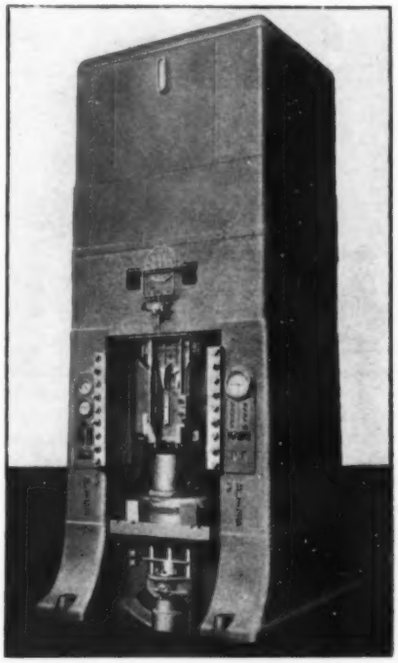
All motion is in the cutter head. The part itself is rigidly held by its fixture. As the cutter returns to center at the end of each operation, a number of successive operations—such as threading followed by concentric counterboring—may be performed in a single work cycle. Parts ranging from ¾ to 20 in. diameter, inside or outside, are handled. Large, irregularly shaped parts are accommodated.



Working surface of the table is 40 × 28 in. Spindle speeds are available between 40 and 370 r.p.m. Clockwise or counter-clockwise rotation of the cutting head is controlled by a switch of the valve control. Selector switch permits the machine to be operated manually when automatic cycle of operation is not desired. Feed cycle ranges from 1½ min. to 8 min. per cycle. Machine weighs 10,000 lb. and occupies a floor space of 40 × 90 in.

Bliss Press Heads Shell Cases At Rate of 250-300 Per Hour

Howitzer shell cases can be headed at the rate of 250-300 per hour on the 1,500 ton hydraulic heading press introduced by E. W. Bliss Co., 53rd St., and Second Ave., Brooklyn, N. Y. Press is equipped with a two station pneumatically operated dial feed, a two-station punch holder, a hydraulic ejector, and a hand operated air hoist. The 105 mm. shell case is placed in the forward station, and rotated into the operating station for the first pressing. After this operation, the reciprocating punch holder brings the second punch into position, and a second pressing cycle with independent pressure is performed.



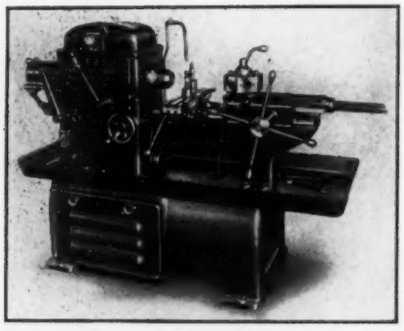
Then the ejector moves the finished

case into the forward station, and operator picks case off with the air hoist. The press is prevented from operating unless dial and punch holder are in proper pressing position. Likewise, the dial and holder cannot operate if press is not in upward position, and the slide will not descend if work is not in the press. For die settings, the functions of the press cycle are separately operated by selector switch.

Diehl Lathe Interchanges Tools With Other No. 2 Units

The No. 2 turret lathe, introduced by the G. M. Diehl Machine Works, Wabash, Ind., takes collets up to 1 in. in diameter. A spindle, cross slide and turret provide for interchanging of tools with other standard No. 2 lathes. Spindles driven through multiple v-belt has six speeds in forward or reverse from 180 to 1,000 r.p.m. The automatic collet chuck and bar feed is operated by the long lever in front of the headstock. Forward movement opens the automatic chuck and feeds the bar stock. Reverse movement closes the chuck.

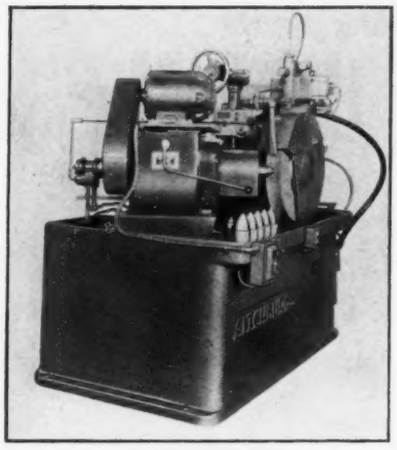
A stepped wedge, operating the closing fingers, automatically compensates



for slightly varying diameters of work. Longitudinal hand feed to the carriage provided by feed screw and nut is operated by graduated hand wheel. Turret slide operates by a turnstile through rack and pinion. Indexing is automatic. Maximum distance from the end of spindle to turret face is 20 in., maximum turning length is 6 in. Cross travel of slide and carriage is 5 in., with a total longitudinal hand feed of 12 in. Swing over bed is 14 in., and six inches over cross slide.

Ogive of 75-mm. Shell Ground By Fitchburg Bowgage Unit

A Bowgage chucking grinder with heavy-duty headstock has been designed by Fitchburg Grinding Machine Corp., Fitchburg, Mass., for grinding the ogive of 75-mm. armor piercing shell. Wheelhead carries a 24 × 3½ in. face wheel. A hydraulic form trueing device which forms the face of the grinding wheel at the proper radius for the nose of the shell is mounted on the wheelhead. Fully automatic cycle is rapid traverse to the work, grinding

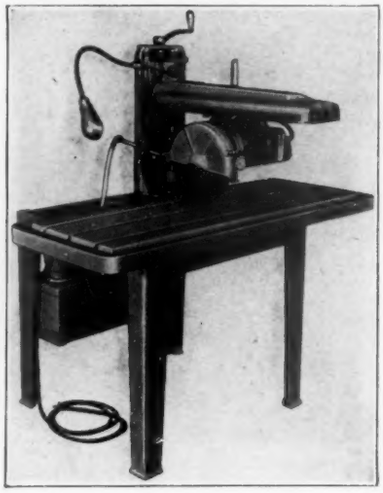


feed, spark-out and rapid return.

Workhead has a parallel-motion jaw chuck operated by a cylinder at the back of the work head. Shell is placed in the open jay chuck which is closed, clamping the work piece at a definite distance from the bottom of the shell. This operation is reversed when cycle is completed, so that shell can be removed.

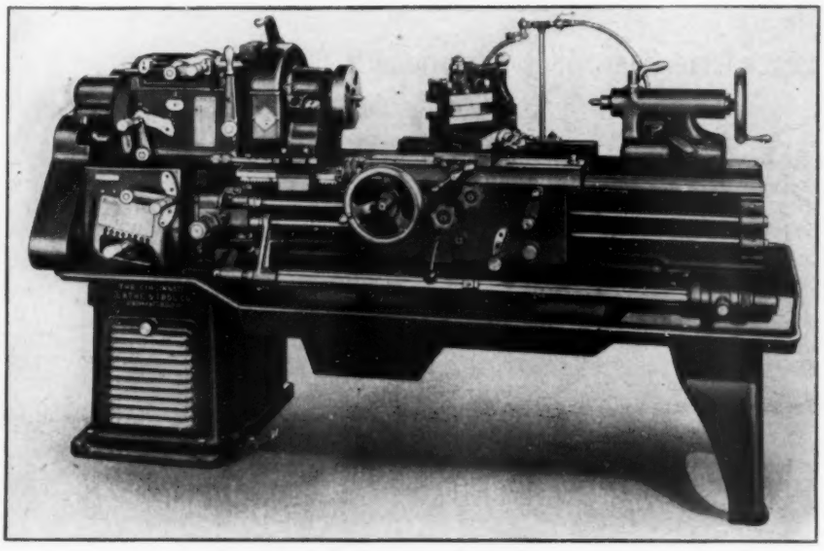
Wallace Saw Cuts Steel, Brass, Bronze, Aluminum

The table assembly on the 1-M metal cutting saw, announced by J. D. Wallace & Co., 150 So. California Ave., Chicago, Ill., holds materials of irregular shape or clamps a vise fixture in any position. With blades or abrasive wheels sliding back and forth on the radial arm, this machine saws hard and soft steel, angle iron, brass, bronze, duralumin and aluminum, as well as non-metallic materials. The column, arm and motor rotate 360 deg. and may be locked in any position for simple or compound angles. Stock is held stationary while the motor unit is pushed or pulled to make the cut. Material up to 4 in. in depth can be handled. Saw blades or ⅛ in. abrasive wheels are used for cutting.



Cincinnati Lathe Equipped With Automatic Feed Stop

The Maxi-Production lathe, introduced by the Cincinnati Lathe & Tool Co., Oakley, Ohio, is equipped with a multiple length automatic feed stop. It has six adjustable length stops automatically indexed by a trip lever mounted in the apron. It may be set to any of the six positions by raising the locking pin on the rear bearing with a stop rod, and turning the index control to the desired setting. The pin assures positive indexing when trip lever is used. The six-position carriage stop when used with a spacing rod provides as many settings as may be required. For multi-cut operations the compound and adjustable rear rest are designed to take the standard tool post, the heavy-duty tool post, or a four-way turret.



Milwaukee Rotary Head Milling Machine

KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

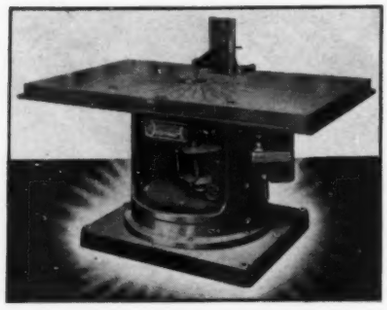
The Milwaukee Rotary Head Milling Machine, primarily developed for tool and die making, is increasingly being used to meet peak production demands on a variety of milling operations. Fast — versatile — flexible — it performs layout, milling, drilling, precision boring and slotting operations with improved accuracy and usually decreases costs.

KEARNEY & TRECKER CORP., MILWAUKEE, WIS., U. S. A.

Milwaukee MILLING MACHINES

Onsrud Shaper Machines Bevel of Varying Angle

A bevel of varying angle can be machined on non-ferrous metals, alloys, plastics, wood and composition materials with the A-69 tilting spindle shaper, manufactured by Onsrud Machine Works, Inc., 3921 Palmer Street, Chicago, Ill. For production work,



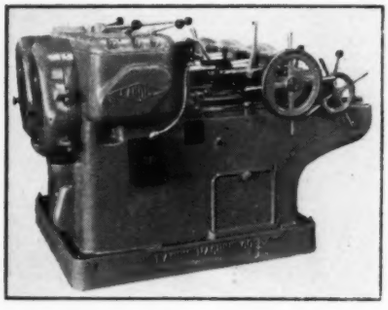
closed or open angles up to 20 deg. can be machined by tilting the spindle and attached cutter at the desired angle. The work is then fed past the cutter by hand, using a fence as a guide. The cutter angle is changed by readjusting a hand wheel and lock.

Since the bevel or plane results not only from the angle at which the cutter is tilted, but also from the direction at which work is fed across the cutter, it is possible with this machine to cut a bevel with any desired series of angles in one set-up and one pass. The largest angle is limited to that in which the spindle is set. Graduated marks on the table indicate angle of feed and enable operator to visually guide the work. A pattern may be fastened to the work to be beveled, and this is fed against an overhead guide pin so that the horizontal shape of the finished piece will be properly outlined.

The cutter is driven at 10,800 r.p.m. by 7½ and 12½ hp. motor. Standard table size is 72 by 44 in., but extensions are available to give a total table length of 144 in. There is a built-in coolant system.

Landis Machine Announces Shell Boring Equipment

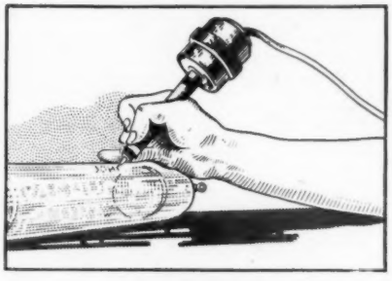
Removal of the excess metal within the bore of the nose end of shell is performed by the shell boring machine announced by the Landis Machine Co., Waynesboro, Pa. This operation occurs after the forming of the shell, and prior to the threading or tapping of



the nose end. A special adapter supports the boring tool of the replaceable bit type. Round serrated grips support the work in alignment with the center of rotation of the machine spindle. Back of the carriage there is a work support which aligns work with the work grips and facilitates handling of the shell. A lead screw is employed to in-feed work to the boring tool.

Breuer Writing Tool Marks Metals and Other Materials

Breuer Electric Mfg. Co., 5100 N. Ravenswood Ave., Chicago, Ill. has designed an electric writing tool for marking brass, marble, tile, glass, plastics, wood, rubber, aluminum, steel and



bronze. The writing tool operates like a pencil and provides more than 7,000 cutting strokes per min. Stroke is adjustable for deep or shallow cutting. The device plugs into electric light socket and operates on 115-130 volts, 50-60 cycle a.c.

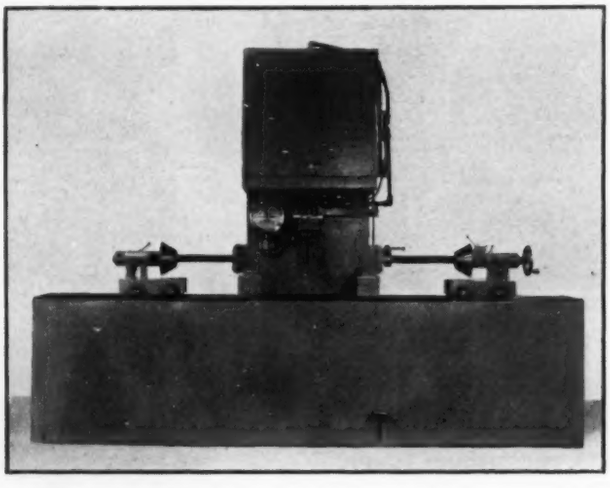
Plane Struts, Gun Barrels Straightened in Keckley Presses

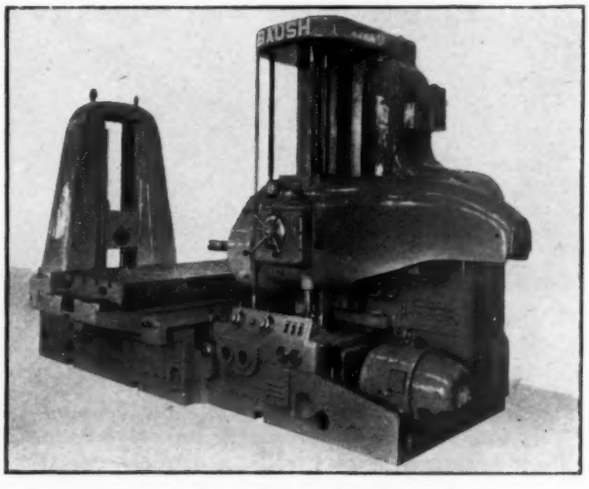
The O. C. Keckley Co., Chicago, Ill., has designed straightening presses for aligning aluminum airplane struts and gun barrels. The presses are made of steel plate sections welded into one integral unit. The strut press has a capacity of 350 tons and a 10-inch ram stroke. The table is 18 × 12 in., and the throat is 9 in. When the pedal of the press is depressed, the ram travels down and continues to the end of the stroke, or until the automatic stop is reached. The weight is 32,000 lb. The gun barrel straightening press is quite a bit larger.

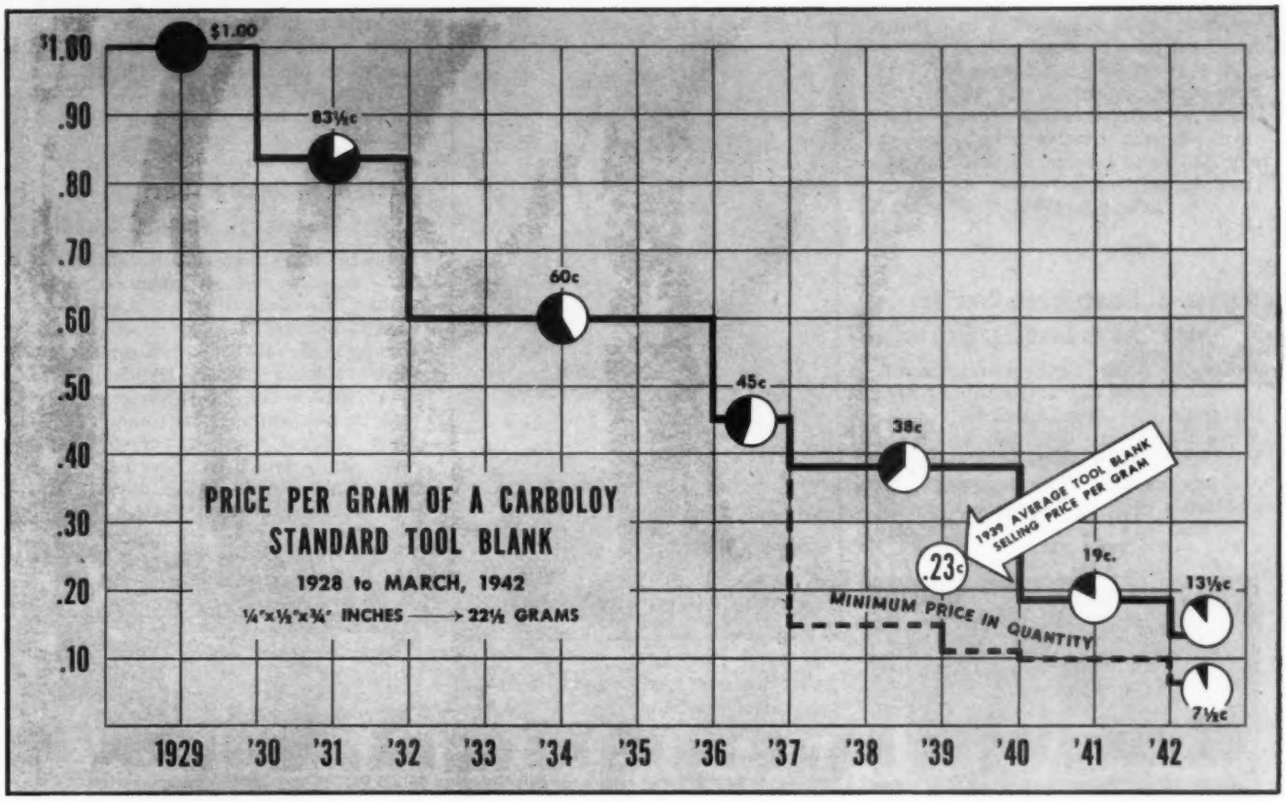
Baush Horizontal Borer Has 48 x 96 In. Work Table

A horizontal boring machine, with 48 × 96 in. table and a cross travel of 72 in. has been announced by Baush Machine Tool Co., Springfield, Mass. Longitudinal travel is 48 in. with a rear support and 72 in. without support. Crosshead has a base plate 18 in. in diameter with T-slot and center plug for mounting and centering large milling cutters. Direct drive is through herring bone gears, while the back drive is through heavy spur gears operating directly in back of the face plate.

The quill, approximately 40 in. long, has tapered take-up at each end for the boring bar. Longitudinal travel of







WHAT PRICE CARBOLOY?

Since October, 1928, Carboloy Company, Inc., has continuously passed on to industry, savings in cost that could be effected without detriment to the broad development program being carried on. Under this policy—despite years of profitless operation—a total of seven price reductions were made. Beginning in 1930, the price of a 22½ gram standard Carboloy tool blank, for example, has been steadily reduced from an original $1.00 per gram—to as little as 7½c per gram today. In larger sizes minimum prices per gram are even lower. Prices of complete Carboloy standard tools are now close to the best grades of steel tools.

Background for this development has been the worst depression in the nation's history—poor years for the costly development work needed. But from that work have come vast strides in processing—refinements of the original carbide—many new carbides—new machines, new grinding wheels, new techniques of design, application and maintenance—extensive training of manpower.

Today—in the midst of the most crucial production era in its history—America is reaping the benefits. It has the *domestic capacity* to produce—is actually producing—vital carbides in unprecedented quantities—completely independent of *outside* manufacturers. It also has the *knowledge* to employ those carbides effectively—to obtain performance in the order of 20 to 1 over ordinary tools.

Contributing largely to reductions in cost has been the steady trend towards standardization and mass production techniques. Originally, practically every piece produced was "hand made." Today, automatic presses—operating 24 hours a day—are turning out thousands, millions of blanks for the nation's war plants. A large proportion of Carboloy production is now standard. Continued effort is being made to further divert special requirements into standard lines. For, greater standardization means greater output—greater economy—greater aid towards victory. ★ ★ Carboloy Company, Inc., Detroit, Mich., Chicago, Cleveland, Los Angeles, Newark, Philadelphia, Pittsburgh, Seattle, Worcester, Mass.

CARBOLOY

Reg. U. S. Pat. Off.

TOOLS • DIES • GRINDING WHEEL DRESSERS
CORE BITS • MASONRY DRILLS • WEAR PARTS

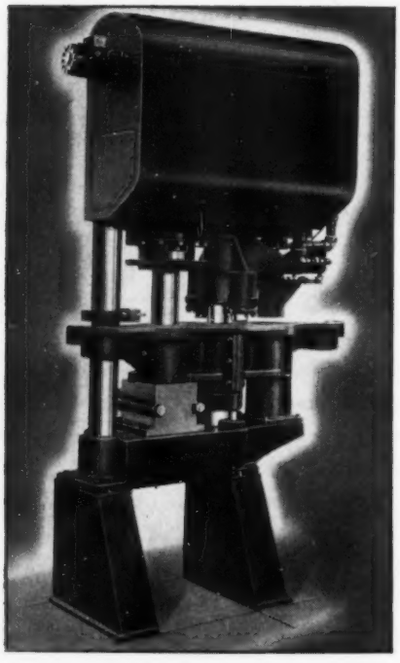
MANUFACTURERS OF TOOLS, GAUGES, ETC., SUPPLYING PRODUCTS TIPPED WITH CARBOLOY CEMENTED CARBIDES

B. C. Ames . . . . Waltham, Mass.
Apex Tool & Cutter, Shelton, Conn.
Barber-Colman . . . . Rockford, Ill.
Bokum Tool . . . . Detroit
Carbide Tool . . . . Chicago
Cleveland Cutter & Reamer . . . . Cleveland
Cleveland Twist Drill . . Cleveland
Cogsdill Tool Drill . . . . Detroit
Colo Carbide . . . Royal Oak Mich.
A. A. Crafts . . . . Boston
Criterion Machine Wks. . . . . Beverly Hills, Calif.
Davis Boring Tool . . . . St. Louis
Detroit Boring Bar . . . . Detroit
Henry Disston & Sons . . . . Philadelphia
Eclipse Counterbore . . . . Detroit
Ex-Cell-O Corp. . . . . Detroit
C. J. Forthman . . . . Cincinnati
Gairing Tool . . . . . Detroit
Gen.Eng.&Model Wks.Pittsburgh
Genesee Tool . . . . Fenton, Mich.
Giern & Anholtt Tool . . . . Detroit
Goddard & Goddard . . . . Detroit
Gorham Tool . . . . . Detroit
Hartley Wire Die . . . . Thomaston, Conn.
Kelly Reamer . . . . Cleveland
Kiffer Tool & Die . . . . Cleveland
Lincoln Park Tool & Gage . . . . Lincoln Park, Mich.
Lovejoy Tool, Springfield, Vermont
Madison Mfg. Muskegon, Mich.
McCrosky Tool . . Meadville, Pa.
Midwest Tool & Mfg. . . . Detroit
Metro Tool & Gage . . . . Chicago
Morse Tool . . . . . Detroit
Morse Twist Drill & Machine . . . . New Bedford, Mass.
Motor Tool Mfg. . . . . Detroit
National Tool . . . . . Cleveland
O. K. Tool . . . . . Shelton, Conn.
Option Tool & Mfg. . . . Pittsburgh
J. S. Popper, Inc., Union City, N.J.
Production Tool Co. of America . . . . Detroit
Reeder Carbide Tool . . . . Detroit
R. & M. Mfg. . . . . Detroit
Scully Jones . . . . . Chicago
Sheffield Corp. . . . Dayton, Ohio
Ralph Shipman . . . . Sunbury, Pa.
Simonds Saw & Steel . . . . Fitchburg, Mass.
Landon P. Smith, Irvington, N. J.
Sommer & Maca Glass Machinery . . . . Chicago
Sprague & Henwood, Scranton, Pa.
Standard Gage, Poughkeepsie, N.Y
Standard Tool . . . . . Cleveland
Staples Tool & Engineering . . . . Cincinnati
L. S. Starrett . . . . Athol, Mass.
Strauss Co. . . . . Pittsburgh
Super Tool . . . . . Detroit
Trubor Tool . . . . Yonkers, N. Y.
Tungsten Carbide Tool . . Detroit
United Twist Drill & Tool, Chicago
Van Keuren Co. . . . . Boston
Harry W. Wagner . . . . New York
Walken Tool . . . . . Cleveland
Wendt-Sonis Drill Wks. . . . . Hannibal, Mo.
Wesson Co. . . . . Detroit
Welmore Reamer . . . Milwaukee

the table and the vertical motion of the cross heads is controlled by a pump. A second pump controls the cross feed of the table and the boring bar. The boring bar is driven by 15-hp., d.c. motor at infinite speeds from 8 to 800 r.p.m. Feed is variable from ½ to 9 in. per min. and can be adjusted at any time during the operation. Rapid traverse in both directions is 50 in. per min.

Watson-Stillman Press Provides Simultaneous Loading, Extrusion

A 125-ton press which permits simultaneous loading and extrusion of plastic materials has been developed by the Watson-Stillman Co., Roselle, N. J. Press has two containers mounted on a swinging arm. Operator starts the automatic cycle by pushbutton control, then loads the free container. The container arm is provided with lifting cylinders for easy swinging and with hold-down cylinders to seal container against die during the extrusion process. Main ram is 12½ in. in diameter and has a 12 in. stroke. Pressing speed is 6.4 ft. per min. at 2,000 lb. per sq.in. pressure. The advance speed is 54 in. per min., while return speed is 150 in. per min. Power is provided by two Vickers pumps driven by a 5 hp. motor. The unit occupies a floor space 4 × 3 ft. and is 10 ft. high.

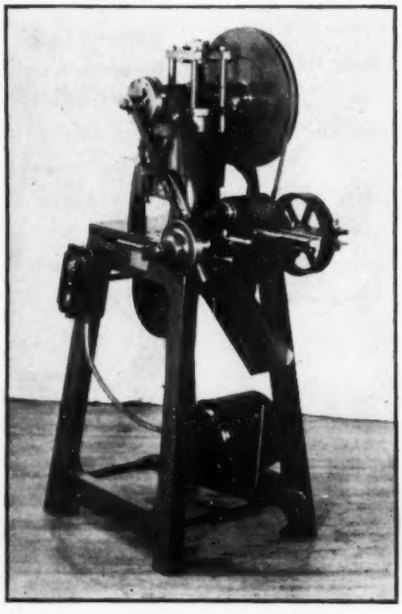


Taylor Drilling Machine Table Adjusts Horizontally, Vertically

The Taylor Mfg. Co., 3056 West Meinecke Ave., Milwaukee, Wis., has developed a bench or floor type drilling machine with a table adjustable 360 deg. horizontally and 90 deg. vertically. It will take drills from 1/32 to ½ in. diameter. Work table is 10 × 11 in., and is set on a 11 × 12 in. base table. Spindle travels 4⅜ in., while drill head travels 24 in. vertically. There are four spindle speeds—860, 1,375, 2,150, and 3,450 r.p.m. Feed mechanism consists of a steel gear rack and pinion manually operated by a lever rod. It is provided with a depth gage.

Diebel Automatic Press Makes 500 Strokes Per Minute

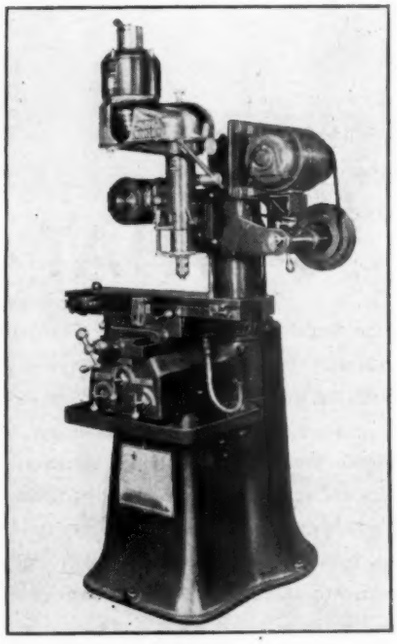
The high speed automatic press offered by Diebel Die & Mfg. Co., 3654 Lincoln Ave., Chicago, Ill. has a maximum operating speed of 500 strokes per min. Feed mechanism will work at all speeds, and can be engaged or disengaged without stopping the press. Feed is adjustable from 0 to 6 in. per stroke. Stock up to 4½ in. wide can be handled. Maximum die size is 6¼ × 8 in. The unit occupies a floor space 20 × 32 in., and is 54 in. high. It weighs 500 lb.



Aircraft Machinery Miller Has Horizontal, Vertical Spindles

Aircraft Machinery Corp., Burbank, Cal. has developed a universal turret milling machine with horizontal and vertical spindles for operation at any angle. These are mounted on a rigid turret rotating 360 deg. Hydraulic feed is provided at infinite rates from ½ in. to 8 ft. per minute. Micrometer stops guard against overrun and hydraulic relief protects cutters against braking or undue strain. Longitudinal hand feed is also provided. Vertical feed is 16 inches.

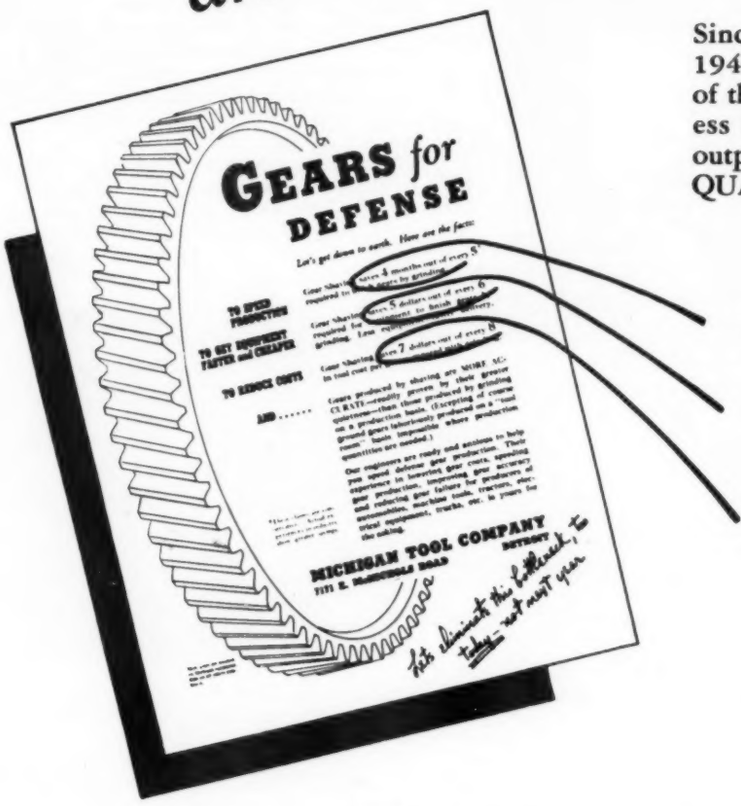
Table measures 7 × 27½ in. Saddle is 12½ in. long with a cross feed of 8½ inches. There are six horizontal spindle speeds from 60 to 2,000 r.p.m. and six vertical spindle speeds from 275 to 5,200 r.p.m. The horizontal spindle is driven by a 1-hp. motor while vertical spindle has a ½-hp. motor.



Leiman Shell Cleaning Machine Feeds Work With Rotary Table

Leiman Bros. Inc., 114-4 Christie St., Newark, N. J., have equipped a sand blast machine for cleaning shell with a rotary table for feeding work. The table extends into the interior of the machine, and while shell are being loaded on the outer edge, shell on the inner edge are under the blasting nozzles. The table is operated by a motor at a prearranged speed, so that all shell or shell parts are sandblasted

---so AERO GEARS, too are now SHAVED* ------


GEARS for DEFENSE
Let's get down to work. Here are the facts:
TO SPEED PRODUCTION
TO GET SMOOTHER, FASTER and CHEAPER
TO REDUCE COSTS
AND.....
MICHIGAN TOOL COMPANY
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7171 E. McNICHOLS ROAD
Let's eliminate this bottleneck, today—not next year.

Since the advertisement at left appeared in 1940, there has been widespread adoption of the "Michigan" crossed-axis shaving process for finishing aircraft gears to multiply output and cut costs—while IMPROVING QUALITY.

Saves 4/5 of the time

Saves 5/6 of the equipment cost

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*Most, but not all aircraft gear designs lend themselves to finishing by shaving. We will be glad to advise you whether or not your gear designs permit the use of the "Michigan" gear finishing process.

There are several types of finishers to choose from—rotary and rack—external and internal—for large gears and small gears.

A battery of "Michigan" rotaries finishing gears in the plant of one aero engine producer.

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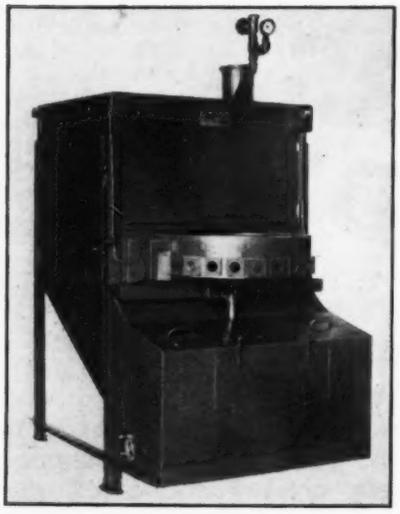
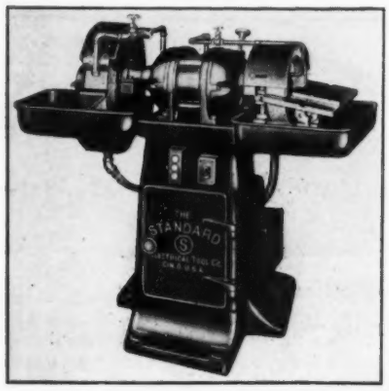


for the required period. A slotted multiple rubber curtain prevents abrasive or dust from escaping. Machine is equipped with two or more adjustable nozzles. Similar set-ups are available for other products.

Standard Grinder Has Wheel For Roughing, One for Finishing

The Type CCGA carbide tool grinder, announced by Standard Electrical Tool Co., Cincinnati, Ohio, has an 18 × 2½ in. straight wheel mounted on one side and a 14 in. cylindrical wheel on the other. The straight wheel is used for roughing operations. On the cylindri-



cal or cup wheel side finish grinding is performed. There is a table here which is adjustable to any angle and can be raised or lowered to permit grinding various size tools. An adjustment is provided to compensate for wheel wear. Power is furnished by 3 hp., 1,150 r.p.m. motor. Machine may be had with a wet grinding attachment.

Dennison Hydraulic Presses Have Lever or Electric Control

Oil hydraulic presses, in capacities from 50 tons up, for straightening, assembling and pressing operations, have been introduced by the Dennison Engineering Co., Columbus, Ohio. Either hand lever or electric control is located in the base, and are so arranged that tonnage pressure applied to the work is within close limits. Press ram is threaded internally for attaching assembling, bending or straightening tools. When the control lever is pushed down, the ram moves at rapid traverse speed until it

contacts the work with a minimum pressure. Pressure to the work is increased by continuing downward movement of the control lever. Electrical control is provided by two pushbuttons which must be operated together, thus tieing up both of operators hands and preventing accidents.

Hammond Abrasive Surfacer Has 6 x 18 in. Working Area

A dry and wet abrasive belt surfacer which can be operated in either vertical or horizontal position has been developed by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. Machine is totally inclosed, and belt can be adjusted to vertical or horizontal position while it is running. Ten-

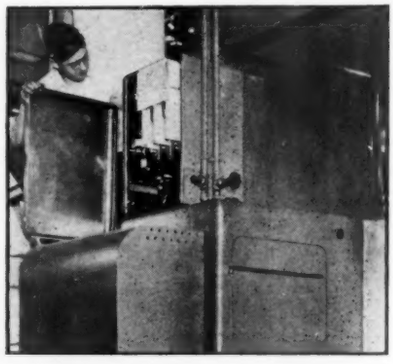
sion is regulated by two handles. Tank and pump unit are mounted in the base for wet operations, but the unit can be connected to water main.

When dry operation is desired, drain connection is removed on an air exhaust system attached. The 6 × 60 in. abrasive belt provide the working surface 6 × 18 in. Belt speed is 3,000 ft. per min. The machine occupies floor space of 20 × 36 in. It weighs 300 lb.

G. E. Air Circuit Breakers Built For Welding Machines

Air circuit breakers which can be incorporated as an integral part of resistance welding machines are available from the General Electric Co., Schenectady, N. Y. In most cases heretofore, welding machines did not include a protecting device, and the purchaser has had to add one.

These breakers are inclosed and can fit behind the steel panels of the welder. The breakers can be removed easily for inspection by unscrewing two screws in the breaker case. Power is entirely



disconnected from the breaker when it is removed, providing complete safety for inspection.

The breakers have a wide range of calibration, offering a choice of trip settings which provide full protection and still allow maximum output of the tube. They can be arranged to open the circuit in case of undesirable conditions such as low-voltage or no "water flow" and also to close the circuit remotely by means of a push button.

Three Dust Collector Units Offered by Hammond Machinery

Self-contained dust collector units in three sizes with capacities ranging from 275 to 1,100 cu.ft. per minute have been announced by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. There are two inlets on each unit, 3 in. in diameter on the Model 30, 4 in. in diameter on Model 40, and 5 in. in diameter on Model 50. There are three filters of glass fiber in each collector which are easily removed for cleaning or replacement. Models 40 and 50 have a shaking mechanism by which much of the dirt can be shaken

The Country Club's new tractor is protecting the Panama Canal

If the fairways of the Country Club are a little rough in spots, members can add a stroke or two and blame it on the Japs. For the materials to produce the new tractor that was going to pull the club's gang of lawn mowers are now in a tractor somewhere in Panama, hauling a heavy gun. Either there or on our farm lands, helping a farmer grow bigger crops. Between them, Private Brown and Farmer Brown get all the new tractors there are.

In this war of blitz and counter-blitz, big guns must have the mobility of tanks. That means a tractor for every heavy gun. Add to these the thousands of tractors our farmers must have, and it is easy to see why the tractor manufacturers must strain every resource to fill the need.

In doing so, they smoothed out important production tasks in cooperation with the Revere Technical Advisory staff. For in all problems of copper and its alloys Revere provides a service, as well as metals, that can make manufacturing operations quicker and easier.

Every ounce of copper and brass our country can produce is needed to win the war. None can be spared for any other use. But Revere is especially well equipped with new plants, improved machines, advanced processes to supply a heavy share of these vital metals. And more facilities are rapidly being added to help get the war won *soon*.

The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

REVERE COPPER AND BRASS INCORPORATED

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK

from the filters into the bottom pan. Air enters the inlets and passes down to the bottom of the unit over a system of baffle plates causing larger particles to fall into the dust pan. Only finer particles reach the filters.

Feed Regulated on Hacksaw Manufactured by Sales Service

Feed pressure to the blade for light and heavy work is regulated on the power hacksaw announced by the Sales Service & Mfg. Co., 473 N. Cleveland Ave., St. Paul, Minn. The saw has a

swivel base vise which takes straight stock 6¾ × 6¾ in. At 45 deg. angle its capacity is 4 × 4 in. Power is furnished by a ½ hp. motor with an automatic switch to stop motor when cut is completed. Blade is automatically raised on the reverse stroke to prolong blade life. There are two cutting speeds.

Amic Comparator Dial Magnifies Measurements One Thousand Times

Indicating dial which magnifies measurements a thousand times makes checking with the Amic Comparator, announced by American Measuring Instrument Corp., 40 West 22nd St., New York, N. Y., an easy task. Instrument is mounted on a heavy cast iron base into which is built a parallel ground and lapped table. Table has vertical micrometer adjustment for setting the Comparator to zero. Throat depth is 4 in., and a working circle of 10 in. is provided by swiveling the head.

Deviations as small as 0.0002 in. can be detected. Total capacity is plus-minus 0.003 in. A disk mounted on the axis of the indicator hand rotates in a permanent field to bring the hand to immediate rest. Measuring pin can be lifted by a lever outside the housing

before insertion of the piece. This eliminates shock to the mechanism and wear to the contact point. Tolerance ranges are indicated by sliding hands.

Osborn End Brush Reaches, Cleans Inaccessible Welds

A power-driven end brush produced by the Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio, is designed particularly to facilitate the cleaning of slag, scale or oxidation from welds on inside corners, or other locations which are difficult to reach. This new brush will get into any space which is accessible for welding. It takes no more room to manipulate the brusn than it does to weld.

By making it possible to clean inaccessible work as thoroughly and quickly as welds which are readily accessible, this new metal-cleaning tool permits faster output of products which are welded. The brush measures ½ in. across the end, or brushing surface, and may be had in three diameters of wire: 0.025 in., 0.035 in., and 0.090 in.

Baldor Announces Charger For Lead or Edison Batteries

An industrial battery charger for three and six-cell lead batteries and for five and ten cell Edison batteries, has been introduced by Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo. Each model is designed to charge a particular size and type battery. If power should fail, battery will not discharge, and the charging operation is automatically resumed when power is restored. Oversize transformers of the two coil type transform the voltage of the a.c. supply line to the required voltage for the size battery to be

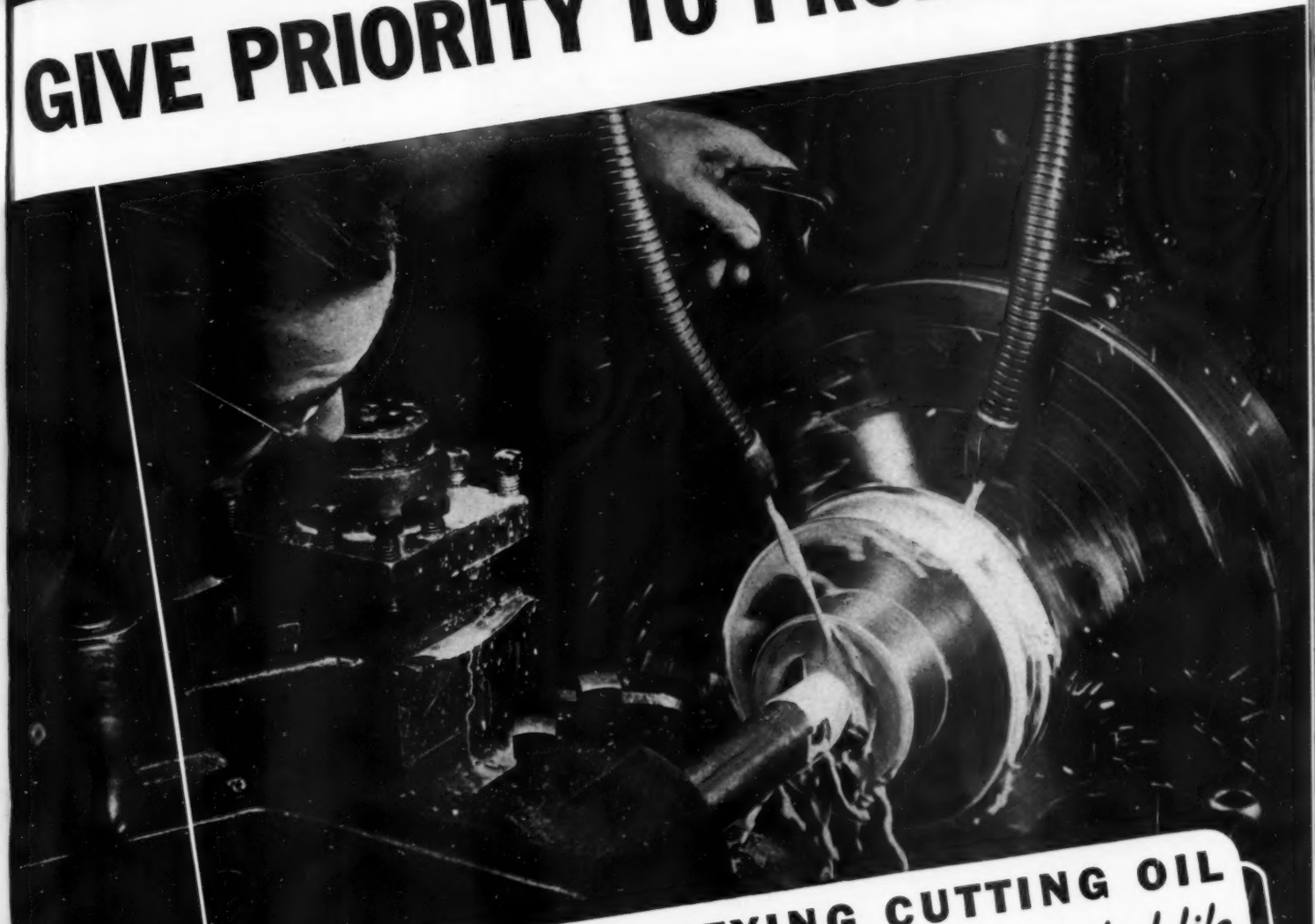
charged. Rectifying bulbs are used to change the a.c. supply to d.c. Taps inside the charger provide for variations in the line voltage. The unit is built into a metal case equipped with cast iron feet.

G. E. Magnetic Relay Contactor Used to Control Pilot Circuits

A magnetic relay-contactor for use either as a relaying unit or motor starter has been announced by the General Electric Co., Schenectady, N. Y. It is suitable for the control of pilot circuits, as a fractional-horsepower motor starter, or for use in conjunction with a magnetic switch controlling large motors, heating or lighting circuits, or signal systems.

The relay-contactor can be supplied in either open form or inclosed in a general purpose housing. It is available in three contact arrangements—single-pole, normally open; double-pole, normally open; and double-pole, double-

GIVE PRIORITY TO PRODUCTION



SUNOCO EMULSIFYING CUTTING OIL

permits increased speeds and feeds . . . longer tool life

To keep American tanks, planes, guns and shells streaming from assembly lines, machine tools — those master tools for victory — must operate at continuous top speed. Unproductive "set-up" time must be cut to the minimum . . . speeds, feeds and tool life increased . . . extreme accuracy maintained — all to produce more work in less time.

That's the problem Sun Oil Engineers — those "Doctors of Industry" — have solved by putting Sunoco Emulsifying Cutting Oil to work in plants throughout the nation.

Sun "Doctors of Industry" are ready . . . willing and able to help you increase machine tool productivity in your shop . . . under your own operating conditions. Their services are yours to use in stepping up output. Write or wire

SUN OIL COMPANY, Phila.

LET'S GO! U.S.A. KEEP 'EM FLYING!

PERFORMANCE DATA

OPERATION — Machining coupling from steel forging @ 98 R.P.M.

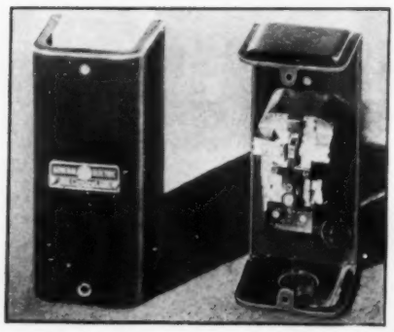
MACHINE — 2-L Gisholt Turret Lathe.

TOLERANCE — .001".

CUTTING LUBRICANT — 1 part Sunoco to 15 parts water.

SUNOCO

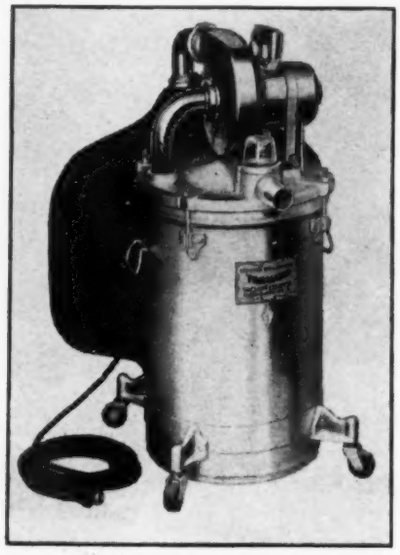
SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA



throw. The unit is rated at 10 amp. when used as a relay; when used as a motor starter, the normally open tips are rated ½ hp., 110 v., a.c. and 1 hp., 220 v., a.c. The case is 3 in. wide, 2¾ in. deep and 6¼ in. high.

Breuer Vacuum Cleaner Picks Up Heavy Debris

The Model 117 vacuum cleaner introduced by Breuer Electric Mfg. Co., 5100 N. Ravenswood Ave., Chicago, Ill., develops sufficient suction to pick up welding flux, scrap, heavy particles of dust

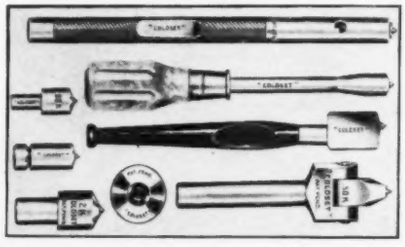


or dirt, water and other materials or debris. Absence of commutator or carbon brushes increases power and speed of operation and permits continuous use. Motor operates on 220 v., 180 cycle current. It has a 20 ft., 4-conductor cable.

Coxhead Varityper Speeds Lettering Large Drawings

An open carriage composing machine for lettering dimensions, bills of material and notes on large drawings, has been developed by Ralph C. Coxhead Corp., 333 Sixth Ave., New York, N. Y. The Vari-Typer eliminates the time consuming job of hand lettering specifications. The typist can generally write instructions on a single sheet within a half day, as compared with the former four to five days of hand lettering. Interchangeable cylindrical type fonts permit use of a variety of styles and sizes of alphabets. The spacing arrangement is variable to permit

use of alphabets with different width letters. Basket-type carriage has open ends and with supporting track can be extended to take 20 ft. sheets.

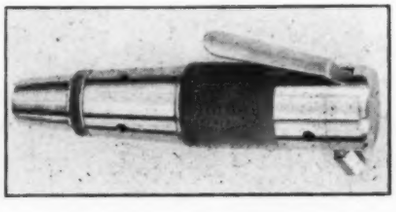


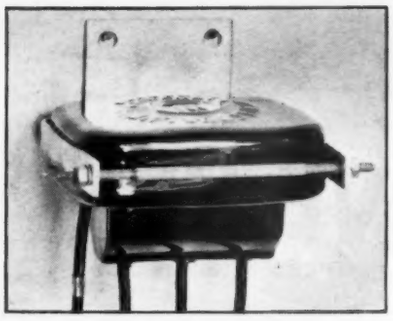
Coldset Mounts Diamonds In Carbon or Stainless Steels

Diamond tools made by setting diamonds in high carbon steel, stainless steel, or monel are offered by Coldset Diamond Tool Co., 35 Maiden Lane, New York, N. Y. Microscopic regularities on the surface of diamonds are mechanically bonded to the metal casing regardless of the shape of the stone. Thus uniform support is assured for the entire mass of the diamond.

Holder Prevents Tools Flying From Borm Pneumatic Hammer

A pneumatic hammer for scaling and cleaning welds, peening, die work, chipping, chiseling, cutting and ripping has been announced by Borm Mfg. Co., Elgin, Ill. Locking holder prevents tools from flying or falling out. Instantaneous air control is provided by the long, conveniently placed trigger. Speed on 100 lb. air pressure is 5,000 strokes per min. The hammer is 8 in. long with a bore and stroke ⅞ × ⅝ in. The tool weighs 3½ lb.



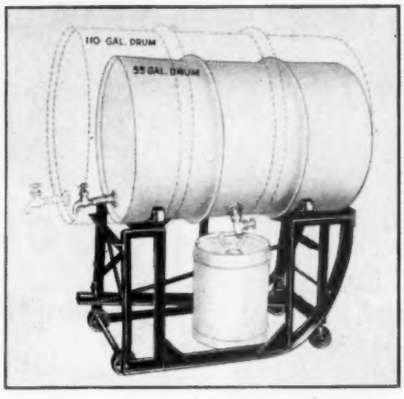


Meters, Secondaries Protected By Westinghouse Outdoor Case

To safeguard watthour meters and secondaries of transformers against lightning, an outdoor protector has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The unit is designed for application on three-phase circuits from 110 to 575 volts. Discharge capacity is 20,000 amp. crest, with gap breakdown on impulse of 2,500 v. average. Cut-off line to ground has a rating of 500 volts.

Morse Drum Cradle Truck Has Retracting Caster Frame

A rugged drum cradle truck intended to handle 55 and 110 gal. drums has been added to the line of the Morse Mfg. Co., Inc., 304 W. Jefferson St., Syracuse, N. Y. This truck has a retracting caster frame which swings inside the rockers when the drum is being rocked up and is then thrown



forward by pressure on the foot lever placing casters well forward and providing a long, wide wheel base. The top of the truck is equipped with four rollers for rotating drums.

Preheating Temperatures Indicated by Tempil Markers

Chalk-line marking sticks which provide an easy method of signalling desired preheating temperatures in welding, in local heating, heat-treatment and metal fabrication have been introduced by the Tempil Corp., 132 W. 22nd St., New York, N. Y. The sticks having

WHEN PROMPT DELIVERY COUNTS SO MUCH

NOW, when your products are so urgently needed, you can profit by the ready availability of the Torrington Needle Bearing. As a result of Torrington's expansion program, Needle Bearings in standard sizes and types can be *promptly delivered on all priority orders!*

You can benefit, too, by the Needle Bearing's other features—features that simplify your designs and speed your production processes. Consider these advantages of the Needle Bearing—and see how *every* one of them fills a wartime need.

IT IS EASY TO INSTALL. Built as a single compact unit, the bearing is simply pressed into place in the housing—a quick operation ideally suited to high-speed production line methods.

IT CONSERVES OTHER MATERIALS on which you may be encountering delivery problems. Because of the Needle Bearing's small outside diameter, you can reduce the size of your housings, and hence the amount of material required.

IT ELIMINATES EXTRA PARTS AND ASSEMBLY STEPS. No retaining rings, washers, or end plates are needed to hold the bearing in place—and in most applications, no special lubricating equipment need be provided.

AND IN PRODUCT PERFORMANCE, the Needle Bearing offers the advantages of long life, high load capacity, low power consumption, minimum need of service attention.

Let a Torrington engineer show you how these features—demonstrated in thousands of peacetime applications—can be incorporated in your wartime designs. For further details, write, wire, or phone for Catalog No. 10.

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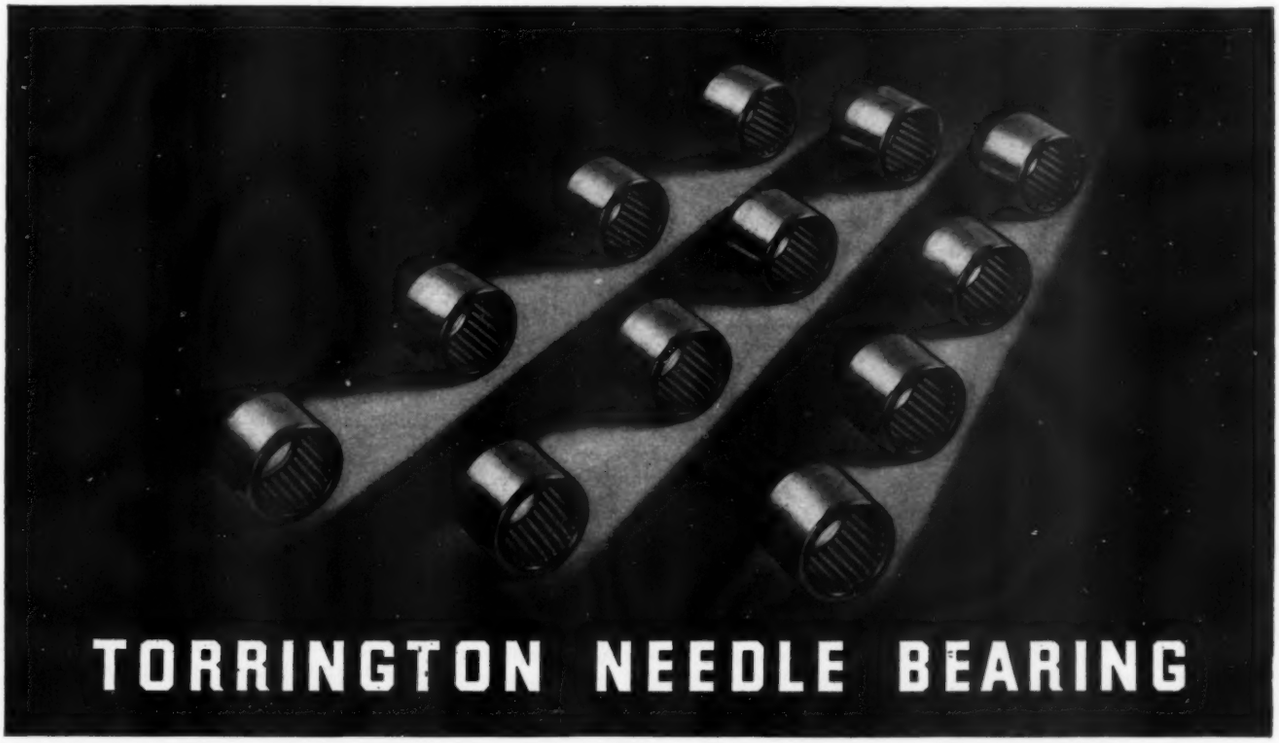
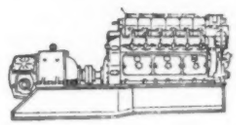
Established 1866
TORRINGTON, CONN., U. S. A.
Makers of Needle and Ball Bearings
New York Boston Philadelphia Detroit Cleveland Seattle
Chicago Los Angeles San Francisco Toronto London, England

LET'S GO! U.S.A. KEEP 'EM FLYING!



TORRINGTON NEEDLE BEARING

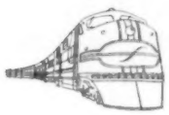
LONG SERVICE LIFE



High load capacity and efficient lubrication of the Torrington Needle Bearing result in long service life on the valve rocker arms of Model 36 Diesels built by Fairbanks, Morse & Co. Bearings reduce the need of replacements and of other service attention.

FAIRBANKS, MORSE

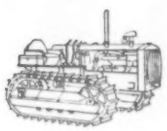
HIGH EFFICIENCY



Efficiency and dependability of operation are essential in railroad auxiliary equipment. Safety Car Heating & Lighting Co., Inc., obtains these advantages by using Torrington Needle Bearings on automatic control valves of its Carrier-Safety air conditioning systems.

SAFETY CAR

EFFECTIVE LUBRICATION



Because the Needle Bearing's outer race forms a reservoir holding ample quantities of lubricant, the need for service attention is reduced to a minimum. Caterpillar Tractor Co. profits by this feature in its famous line of "Caterpillar" Diesel Tractors.

CATERPILLAR TRACTOR

IF YOU NEED
A LUBRICANT
of
INCREASED
LOAD
CARRYING
CAPACITY
use
"STURACO"
EXTREME PRESSURE ("EP")
MACHINERY
OILS & GREASES

HERE is the answer to many of your lubrication problems caused by today's production demand of heavy loads, high speeds, and continuous operation of machinery and machine tools. "Sturaco" EP Oils and Greases, without any change in your accustomed viscosity or consistency, offer a minimum of *300% increased load carrying capacity* with notable low torque.

Lubrication of ways—spindle bearings—gear heads—elevating screws—speed reducers — are typical examples where "Sturaco" application has solved tough lubrication problems. If you need help, write or phone today.

● SEND FOR the new "Sturaco" booklet outlining laboratory research behind this genuine development, describing typical applications and listing various grades.

For All Cutting Fluid Problems
D. A. STUART OIL CO.
LIMITED
Chicago, U.S.A. Est. 1865
Warehouses in All Principal Metal Working Centers

a specified melting point are available at convenient temperature intervals from 125 to 1,600 F. Their mean accuracy is within 1 percent of specifications. In actual operation, the stick is drawn across a surface. When the temperature of the material reaches the rating of the stick, the chalk-like mark melts to a liquid streak. Thus, the temperature of the material is designated.

de Sanno Grinding Wheels Used On Copper, Aluminum, Hard Alloys

Grinding wheels, whose structure is stringy, porous and sponge-like, have been announced by A. P. de Sanno & Son, Inc., Phoenixville, Pa. These wheels take deep sized cuts, and increase man-machine output. Air cells keep grinding contact cool. The wheels can be used for hard alloys, copper, aluminum, wood, rubber, plastics and soft materials.

M. & W. Transparent Coating Prevents Flying Window Glass

A transparent protective coating for windows which prevents glass from flying when broken has been developed by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J. Glasshield is applied in two coats on inside surface of a window pane. Further protection can be provided by giving outside surface similar treatment. Coatings are applied with a brush and take one hour to dry. It can be removed with a razor blade.

NEW MATERIALS

Maas Transparent Finish Substituted for Other Coatings

As a substitute for electroplating and bronze powder finishes, the Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J., has developed a transparent finish for use on polished metal. Known as "Platelustre," it is a concentrated enamel which is added to clear lacquer. The finish is applied by spraying or roller coating and can be furnished for either air drying or baking. Flat stock finished with certain grades can be formed after baking.

Bunatol, Applied by Dipping, Resists Acids and Alkalis

A heavy liquid which forms a coating resistant to water, acids, alkali, oils and grease, is produced by the Nelson J. Quinn Co., Oakwood at Clinton St., Toledo, Ohio. Bunatol is applied by dipping, although it can be sprayed or brushed. Air drying time is 45 min. for each coat. Drying may be speeded up in a low temperature oven. Eight dipped coats will give a heavy and thick insulation. Bunatol forms a permanently flexible film. The flexibility is retained for the life of the insulation during months of use, even though it may pass through hot and cold tanks of strong acids and alkali solutions.

TRADE PUBLICATIONS

BRUSHES Carbon, graphite and metal-graphite brushes are shown in Catalog K-15 issued by the Keystone Carbon Co., Inc., 1935 State St., St. Marys, Pa.

DIE MAKING A catalog of die sets and die makers supplies is offered by Detroit Die Set Corp., 2897 W. Grand Blvd., Detroit, Mich.

EYE SHIELDS Safety glass eye shields for use on grinding, cutting, spot-welding and buffing machinery are described in a folder by Edward Bruns, 4531 Ravenswood Ave., Chicago, Ill.

FINISHING Facilities for finishing many products are described and illustrated in a folder by the DeFoe Finishing Co., 1752 N. Kimball Ave., Chicago, Ill.

HANDLING CHEMICALS Safety equipment to be used in the handling of acids and other chemicals are illustrated and described in a folder issued by Pulmosan Safety Equipment Corp., 176 Johnson Street, Brooklyn, N. Y.

MAGAZINE Copperweld Steel Company, Warren, Ohio, has started publication of a quarterly, "The Aristoloy Magazine."

MARINE GEARS Farrel Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y., has announced a 36-page booklet describing and illustrating marine reduction gear drives in service.

METALS A sampler showing plated metals and listing typical uses for them has been prepared by the American Nickeloid Co., Peru, Ill.

NITRIDING The Nitralloy Corp., 230 Park Ave., New York, N. Y., has published a 40-page data book including tables, charts and data on the composition of Nitriding Steels, preliminary treatment, physical properties, the Nitriding process, and a section on the machining of Nitriding Steels.

PRESSURE RECORDERS A 32-page catalog, No. 22-A, showing instruments for the measurement and recording of industrial pressures has been prepared by the Foxboro Co., Foxboro, Mass.

PUMPS Direct connected rotary pumps are described in a four-page folder, circulated by the Blackmer Pump Co., Grand Rapids, Mich.

Second Line of Defense

While the Army and the Navy are the first line of defense in mechanized war, industry is no less than the second line of that defense. Therefore:

First—We must continue to load our facilities in plants, man-power and personnel to the very limit of their ability to carry a load just as fast as war work is assigned to us.

Second—We must use every ingenuity to get the projects that are still in the make-ready stage into mass production at the earliest possible time.

Third—We must keep after this time-saving thing in the spirit and with the courage that accomplishes miracles!

Fourth—We must render every assistance to our armed forces in speeding up the stupendous job of training the millions of recruits (non-technical men) in the proper use, care and repair of the highly technical mechanized equipment that we are being called on to build.

Fifth—And to these ends, we must cooperate with one another to the fullest—intelligently and unreservedly.

From a talk by O. E. Hunt, Engineer, General Motors Corporation, at a meeting of the Automotive Council for War Production.

Spring Housecleaning

Now is the season for a thorough-going housecleaning in the shop. Special attention should be given to uncovering tools and tool steels that have been hidden in bench drawers and tucked away behind machines.

Tool steel is scarce today, and deliveries on small tools are slow. All usable small tools should go back to the toolroom and be reconditioned if possible. The ends of single-point cutting tools come in handy for use as tips with carbon shanks. All that is left over can be classified for remelting. It will pay in time saving and shop costs.

Research Makes Jobs

"Basic research provides a foundation for new industries. As soon as this emergency is over most of the men now engaged in the production of munitions are going to be out of jobs. Consequently, there will have to be a tremendous readjustment of employment, and it is important that we should, so far as possible, work out now some means of providing employment at that critical time. Further, I believe that after this war our country will be confronted with the most intense industrial competition from overseas that we have ever known. Unless we can provide those things that are made abroad as cheaply as our competitors can, our market and then our employment will suffer. So I am very anxious to see that every possible step

Advertisement

Warehouse Stocks of Steel Proving Big Help in Keeping Manufacturers Operating

A recent survey of industries indicates that most manufacturers are relying on nearby steel-service plants, more than ever before, to fill their requirements for small lots of steel. The leading company in this steel stock service is Joseph T. Ryerson & Son, Inc., who operate a vital network of 10 plants strategically located in busy industrial centers across the country.

The close cooperation between Ryerson's 10 plants offers two unique advantages.

First—Jobs at distant points; or the steel requirements of branch plants can be more quickly handled through local Ryerson offices. A local Ryerson office will take immediate action to assure prompt shipment.

Second—The local Ryerson office handles that *all important* "follow through" which assures prompt, accurate deliveries. Bring your steel needs or problems to Ryerson for prompt, intelligent cooperation. Phone your nearest Ryerson Steel-Service office. (See advertisement below.)

Through Peace and War—

A Century of Service—

THROUGH 100 YEARS of peace and war in good times and bad—Ryerson has served industrial America. As in every other crisis, we continue to provide steel to meet the emergency requirements of our nation at war.

JOSEPH T. RYERSON & SON, INC.

CHICAGO • MILWAUKEE • DETROIT • ST. LOUIS • BOSTON • BUFFALO
CINCINNATI • CLEVELAND • JERSEY CITY • PHILADELPHIA

STANDARD CONVEYORS

"First Line" Equipment in Armament Production!

Standard Conveyors of a Special Spool Type are used in large plant for line production of 3 inch A. A. Shell. View shows a portion of the extensive Standard Conveyor system used to carry shell, safe and fast, through various stages of production.

Conveyors—planned and installed by Standard—are a basic part of the high-speed, mass-production equipment increasingly being called into use to step up defense production. They are of vital importance in cutting short handling time, eliminating repeated handling, avoiding wasteful waiting for materials—they help speed production all along the line.

TO SPEED PRODUCTION . . . CONVEYORIZE

In every plant there are production operations which can be "conveyorized" with substantial savings of space, time and costs. Handling incoming material—work in process—moving finished products to shipping or storage—at any one or all of these points Standard Conveyors can substantially step up production.

Send for Bulletin AM-10 "Conveyors by Standard," showing what Standard has done for many manufacturers.

STANDARD CONVEYOR COMPANY

General Offices: North St. Paul, Minnesota

Sales and Engineering Offices in Principle Cities

is taken toward providing new industries which will manufacture new things that people will want, in addition to what they already have. That is the foundation of prosperity, and that is what will give our people employment. . ."

From an address by Lyman G. Briggs, Director, National Bureau of Standards, and President, National Conference on Weights and Measures, before the Thirty-First Conference on Weights and Measures, June 3, 1941.

Labor Cooperation Needed

By JAMES F. LINCOLN

Lincoln Electric Company

It is obvious that anything which interferes with the efficiency of our production will eliminate the possibility of our winning against our present enemies because they have no such preconceived limitations—they are going to win or die.

Our method of retaining our so-called gains actually means, in terms of production, that management does not manage industry. That is done by the workman. Management from its knowledge and ability knows how to increase production—labor, by union rules or by preconceived notions, will have none of it. Management could better production by a new and better technique—labor to a large extent fails to cooperate. Management can make the tools to win this war—labor with its present power will not go along.

We cannot win from an intelligently and imaginatively led people of equal manufacturing ability by a chaotic, undisciplined, uncooperative mass of individuals armed with the power given them by the present government. We have the ability in management, as has been demonstrated over the years, to build better products in a shorter time and at a lower cost than any competitive nation, but to do that we must use the ability, the experience and the imagination of our present industrial management to the fullest in accomplishing just exactly that end. Instead of doing that at the present time, we are using that management for the clearing up of minor bickering between various trades, between various men in the same trade, and between various individuals. If the present chaotic industrial condition is the only way that our so-called social gains can be retained, we can be sure they will disappear in the climatic defeat which faces us in the present war.

The first thing we must do to win the war is to win the battle with ourselves and become a united industrial nation with the ability of managing the production of willing, enthusiastic and disciplined workmen whose ideal is efficiency and whose watchword is "cooperation."

Abstracted from a radio address.

MASONITE* DIE STOCK

Easy to pick up, hard to break down!

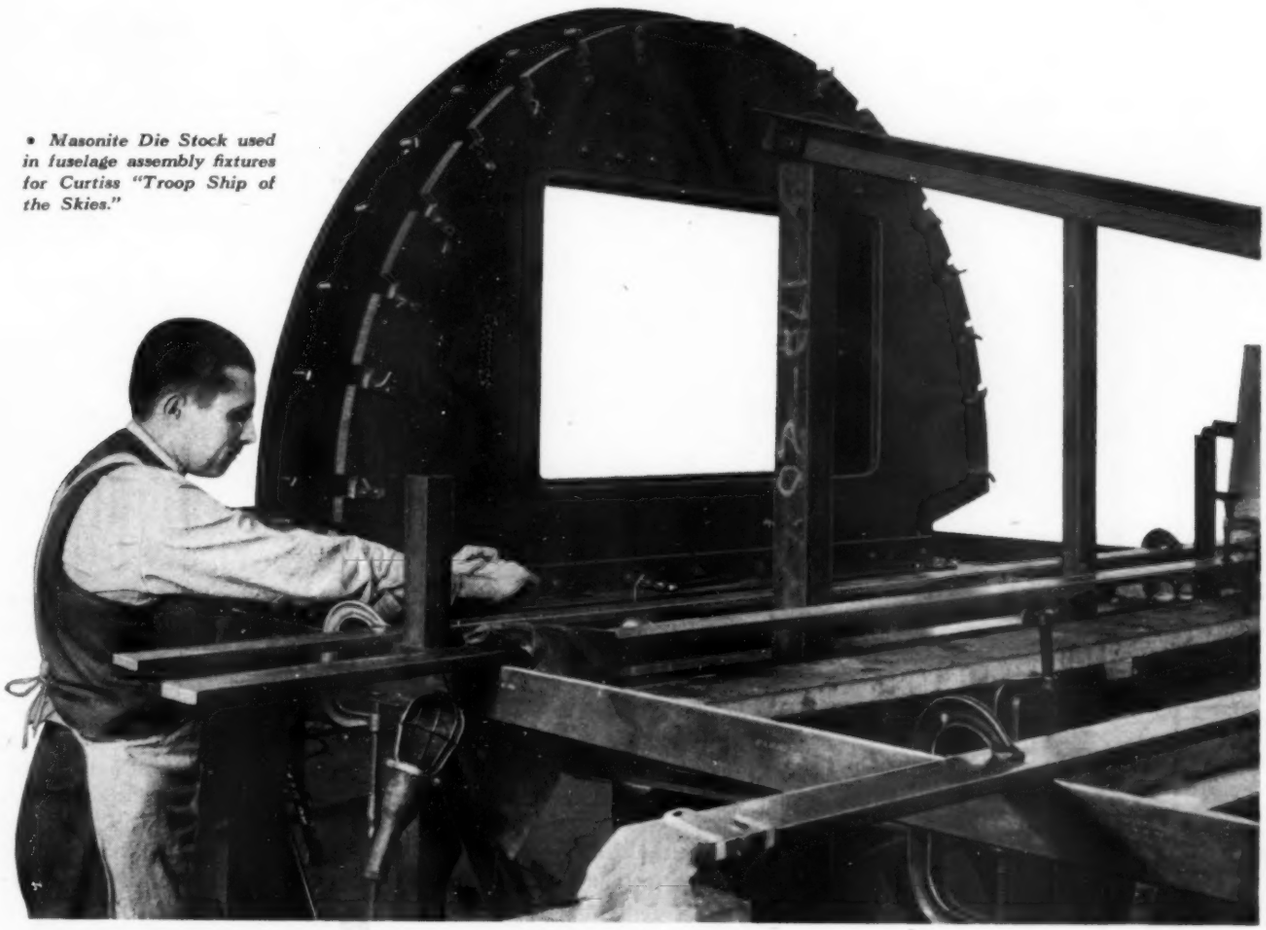
MASONITE DIE STOCK—now widely used by the aircraft industry in the fabrication of fixtures for assembling formed metal parts —saves precious time, energy and money.

There is less need for crane or special equipment in transporting or installing fixtures made from this amazing, semi-plastic material. It's only one-sixth the weight of steel yet durable and strong enough for production assembly requirements.

Masonite Die Stock makes possible low-cost fabrication. It can be drilled and tapped for threads for attaching clamps and gauges. Also press fit drill bushings can be inserted.

While its most spectacular success is being demonstrated in the aircraft industry, Masonite Die Stock is also being used by other manufacturers to do a faster, better job at less cost and effort.

Masonite Die Stock is available in thicknesses of ¼ to 2 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. For further details, fill out and mail coupon.



• Masonite Die Stock used in fuselage assembly fixtures for Curtiss "Troop Ship of the Skies."

*TRADE-MARK REG. U. S. PAT. OFF. "MASONITE" IDENTIFIES ALL PRODUCTS MARKETED BY MASONITE CORPORATION. COPYRIGHT 1942, MASONITE CORP.

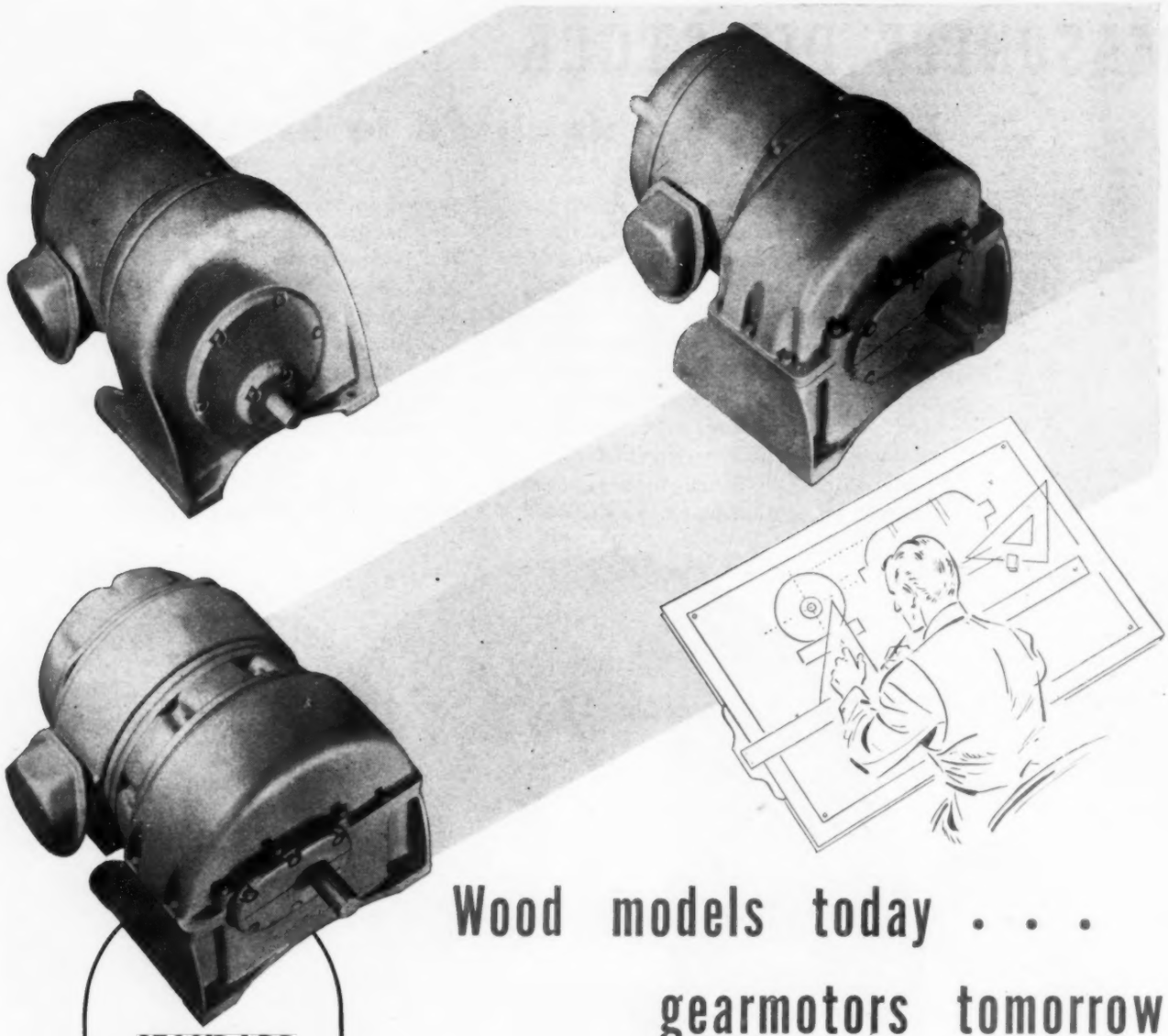
MASONITE CORPORATION *Dept. AM-42, 111 W. Washington St., Chicago, Ill.*

Please send me illustrated literature and complete information about the new Masonite Die Stock.

Name and firm _____

Address _____

City _____ *State* _____



Wood models today . . . gearmotors tomorrow

Quieter, more efficient slow-speed drives don't just happen. Improved performance is engineered—by constant, unremitting research and experiment.

Westinghouse engineers have been on this job since 1887. And today they are still working with tests and models like the ones shown above for more efficient methods of mounting, more adaptable design, and even quieter operation.

Westinghouse continues to find better answers because it attacks the problem as a whole. Westinghouse Gearmotors are designed, built and tested as complete units. Because of efficient gear-cutting processes and careful matching of motors and gears, Westinghouse is able to provide slow output speeds with efficiency as high as 98%.

Specify a Westinghouse Gearmotor for every type of slow-speed drive, whether single, double, or triple reduction or with special enclosures. For the up-to-the-minute answer to your slow-speed drive problems, see your Westinghouse representative. Or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Department 7-N.

J-07191

STANDARD A.G.M.A. OUTPUT SPEEDS

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

1430	190	25
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
520	68	9.0
420	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

AGMA

Westinghouse

GEARMOTORS

". . and KEEP YOUR POWDER DRY!"

IT was in 1642 that Oliver Cromwell admonished his never defeated British army, the Ironsides; "Put your trust in God, and keep your powder dry." That order applies equally today as when soldiers carried powder horns.

. . . FIBREEN is Keeping America's "Powder" Dry on Land and at Sea—

Powder, today, means shells, grenades, and bombs—and also planes, tanks, food, clothing, radios, range finders, surgical equipment, medicines and chemicals, electrical supplies; in fact, all the complicated equipment of modern warfare.

Damage to any of this material while in storage or in transit, while exposed on shipping platforms or yards, at docks or at supply dumps, can be just as disastrous, today, as water in the powder horns of Cromwell's musket men in 1642.

FIBREEN is doing its part in providing safe packing and protection for goods of war. It's tough and strong. It's waterproof. Used as a liner or wrapping, it furnishes vital protection, guarding against damage by rain, dirt, sea water, salt air, and long exposure to all kinds of weather from extreme heat to freezing cold.

FIBREEN is a pliable, rugged paper—reenforced by wire-tough, closely spaced fibres running crosswise and lengthwise — embedded in two layers of asphalt, between two layers of strong kraft. It's inexpensive—an effective replacement for packing fabrics and materials no longer available.

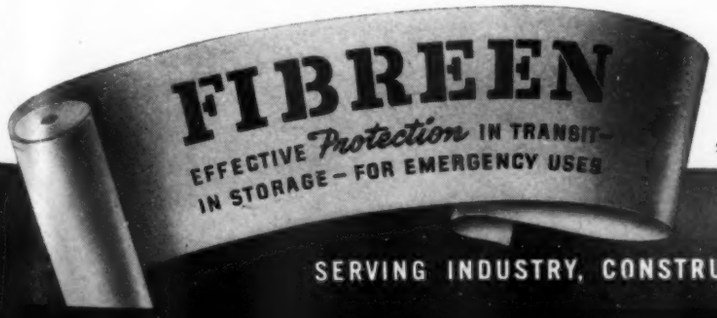
FIBREEN is available to those in essential industries. If your product is in this class, write explaining what you make, and how it is now packed. We'll try to help you.

THE SISALKRAFT CO.

Manufacturers of Sisalkraft, Fibreen, Sisal-X, Sisaltape and Copper-Armored Sisalkraft.

205 W. WACKER DRIVE · CHICAGO, ILL.
NEW YORK SAN FRANCISCO LONDON SYDNEY

In Canada Write to Alexander Murray & Co., Limited, at
Montreal · Toronto · Halifax · Saint John · Winnipeg · Vancouver



SERVING INDUSTRY, CONSTRUCTION AND AGRICULTURE THROUGHOUT THE WORLD

DoAll meets the Challenge

THIS remarkable Contour Machine is speeding along the steady flow of vital equipment for army, navy and air force by doing a lion's share of cutting tough metal and alloy parts of every description in airplane plants, arsenals, shipyards, etc.

On hundreds of production jobs, DoAll is doing a week's work in a day, a day's work in an hour, an hour's machining in 10 minutes.

DoAlls range in price from $1,000 to $5,000 complete with necessary equipment; yet are relieving $10,000 to $50,000 machine tools of over-load work with valuable savings of time and metal.

AIRPLANE SKIS

Made on the DoAll. Operator is cutting 12 pieces of .0125-24 S.T. Duralumin at the same time. A single ski has 24 separate cuts. Formerly cutting was done, one at a time with large hand shears.

DoAll Contour Sawing
BAND SAWING
BAND FILING
BAND POLISHING

★Fastest precision method of removing metal

CONTINENTAL

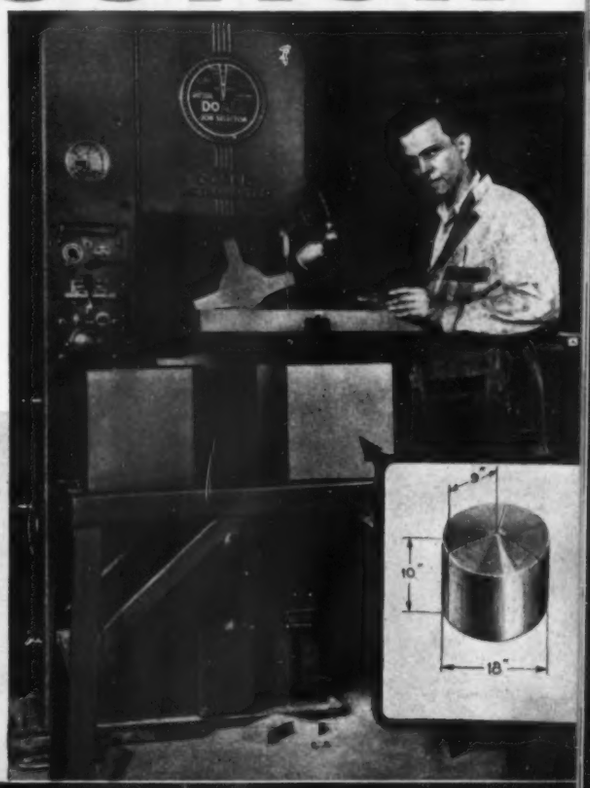
Associated with the DoAll Company, Des Plaines, Ill.
Manufacturers of Band Saws and Band Files for DoAll Contour Machines.

for faster PRODUCTION

Keep the planes, ships and bombers coming! That's the demand on American industry today. Every ounce of energy, every improved method to increase output must be used.

NOW . . . . AND WHEN PEACE COMES . . . .

Whether you are doing war work on direct or sub-contract, you need the DoAll—the most versatile machine for production.



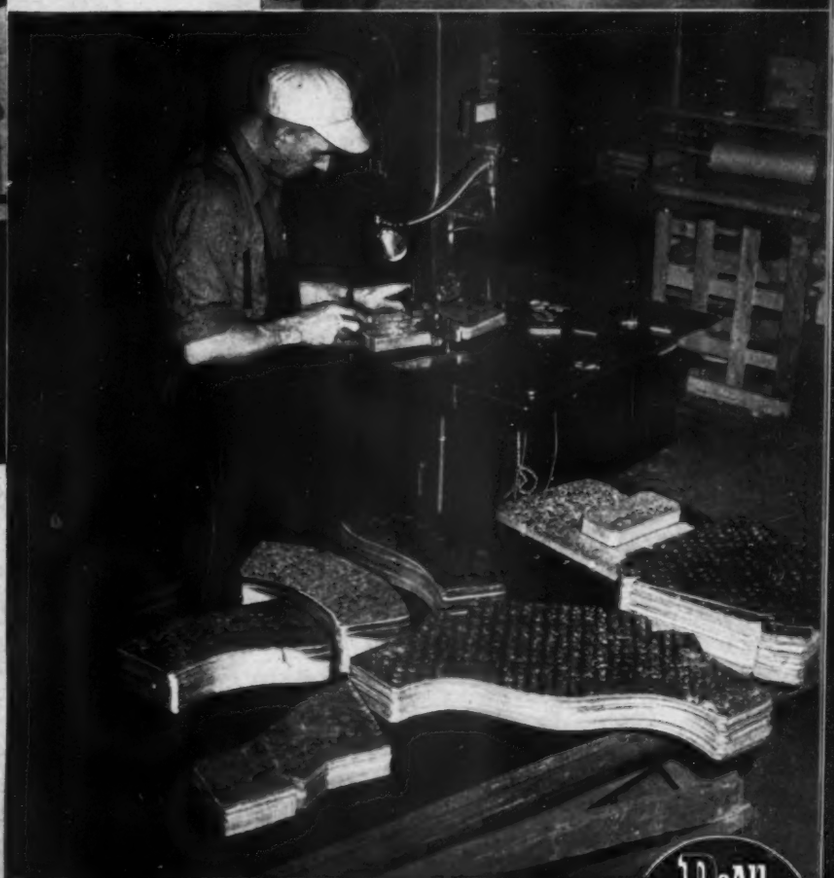
AGITATOR MOLD

At Emmett Mold, Inc., this Washing Machine Agitator Mold was made in 13½ hours on the DoAll. Material is Chrome - Vanadium Steel 10" thick, 18" diam. Weight 720 lbs.

And—when the war is over, the DoAll won't have to be scrapped, but can be put to immediate work on your shelved peace-time orders without changing a single nut or bolt.

Available are 42 different sizes and styles of band saws, 23 band files, 3 polishers, a "best" one for every kind of work.

Let us send a factory trained man to show you just what the DoAll can do for you now and later.



HAMMER DIE

At American Fork & Hoe Co., this 10" thick Hardten Tool Steel Forging Die to make hammers was cut on the DoAll. Saving was about 80% in time and a great amount of metal over any other method.

AIR CONDITIONING DUCTS

At Char - Gale Mfg. Co., 50 parts are cut at a time from 30-gauge galvanized iron. Operator can cut 1000 or more parts a day, which is 3 to 4 times faster than the old method, one at a time with hand tin-snips — and a much neater job.

MACHINES, INC.

1310 S. Washington Ave., Minneapolis, Minn.

NEW—Send for the interesting and helpful book "DoAll on Production"

DoAll Contour Sawing
BAND SAWING
BAND FILING
BAND POLISHING

100 Name Plates ENGRAVED in 12 Hours . . . .

Engraving Template

...ON A GORTON PANTOGRAPH ENGRAVING MACHINE

ENGRAVING 100 name plates in 12 hours without resharpening the tool, at the Barber-Colman Company, Rockford, Illinois, is a typical example of what can be produced on a Gorton Pantograph Engraver.

The operator is shown engraving a bakelite name plate for a Barber-Colman control unit panel. The name plate is copied from a template (shown above) using a 5/16" diameter carboloy-tipped cutter. The tracer point is guided by hand around the outline of the template, which is clamped on the copy table.

In addition, the Pantograph Engraver may be used for engraving dies, molds, dials, flat and curved work, and other general engraving work. The machine may be operated by unskilled labor, and only a few minutes are required to explain the operation of the machine.

If you have work of this type in your plant, the installation of a Gorton Pantograph Engraver will not only improve the appearance of your product, but may also reduce the cost on all of your engraving work. Your request for additional information on Pantograph Machines will not obligate you, and will give you the information necessary for checking more carefully into its possibilities for your work.

FREE CATALOG—Send today for your FREE copy of Bulletin No. 1580-A, showing how Gorton 2 and 3 Dimensional Pantograph Machines are used to produce Stencils, Dies, Rolls, Steel Stamps, Relief Engraving and general flat work.

GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

FASTER DRIVING • LESS EFFORT • BETTER WORK
= 50% LESS ASSEMBLY COST WITH PHILLIPS SCREWS

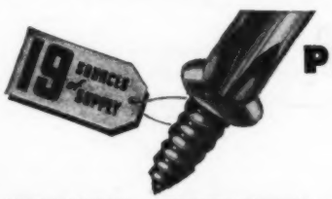
It seems reasonable to expect more production and better work from a man who doesn't have to sweat and strain (and curse) in order to drive a screw.

Plants which have switched over to Phillips Recessed Head Screws do find that quantity and quality both respond nicely to the change. The Phillips Screw clings to the driver, transmits driving power more efficiently, prevents screw-driver slippage, drives straight automatically and doesn't chew up when you start to drive it home. On top of that, it is more often practical to use electric or pneumatic drivers.

With so many nuisances and strength-wasters eliminated, operators do better work, even in awkward positions or even if inexperienced. Where accuracy is important, it is easier for them to line the job up right — seat the screws securely — and avoid costly rejects.

So keep your men cool as cucumbers with Phillips. Meanwhile, you'll be pleased as Punch to find that assembly costs are cut in half as a result of Phillips Screws.

Any of the Phillips Recessed Head Screw manufacturers listed below can furnish screws and facts.



PHILLIPS RECESSED HEAD SCREWS
GIVE YOU 2 for 1 (SPEED AT LOWER COST)

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

COMBAT TEAM

Machines and cutting tools – this is industry's crack combat team. Only with first quality tools can you show significant results in war production!

MORSE

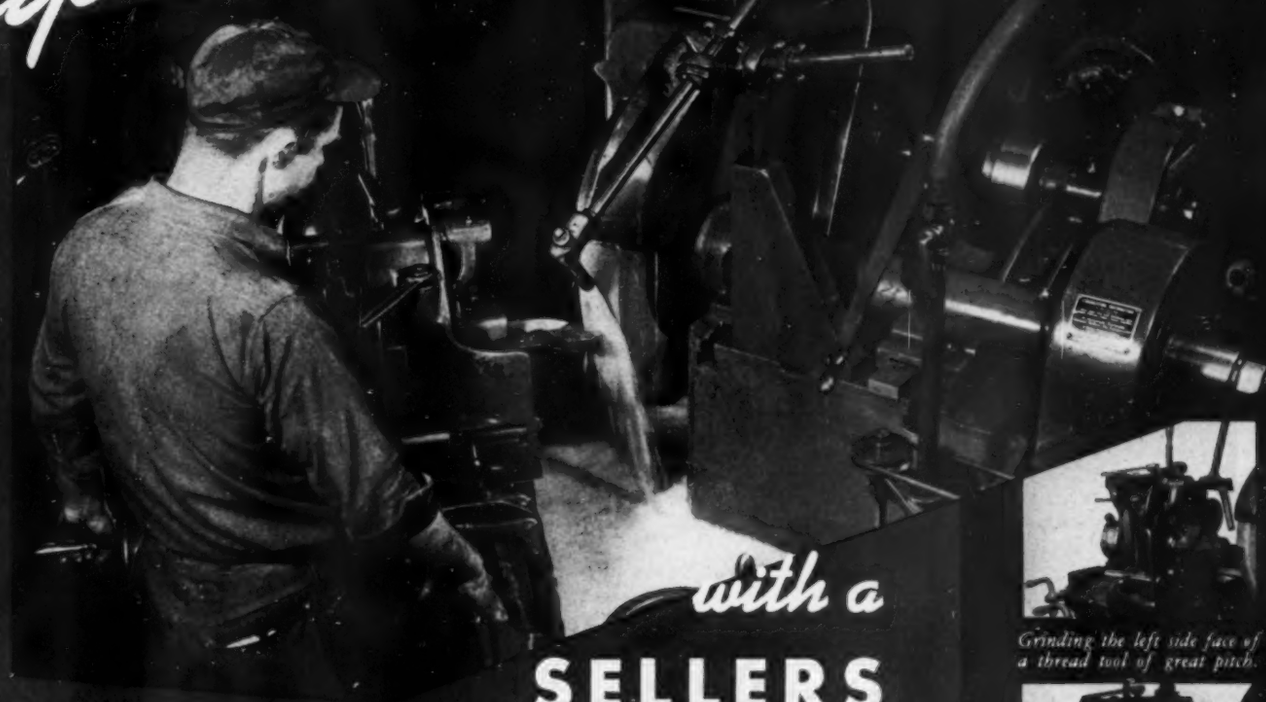
THERE IS A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY

NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

Keep 'em Cutting!



with a

SELLERS

Heavy Duty TOOL GRINDER

Sellers No. 5T and 6T Tool Grinder grinds any cemented carbide or high speed steel, straight or convex curved face tools, including thread tools of any angle of thread or pitch, internal or external, and will accurately reproduce the desired angles and clearances on all the tools. It handles all sizes of tools and tool bits from ¼" up to the maximum size of the chuck used, 2" x 2½" or 3" x 3" square.

This machine does all the work necessary to finish to shape from either forged or bar stock cutting tools for lathes, planers, boring mills, etc., making it possible to maintain, ready for use, a full supply of such tools. It effects savings in tools by removing the minimum amount of tool material, in production costs by producing the exact shapes required to maintain high cutting speeds, and in grinding time, by more rapid shaping and sharpening.

It is also applicable for grinding double end cutters for boring bars, fly cutters, inserted teeth for heavy saws, rock drill bits, round punches, chisels, oil grooving gouges, etc., by means of special chucks or holders.

Write for bulletin or special information

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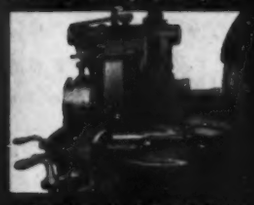
FOUNDED SELLERS 1848

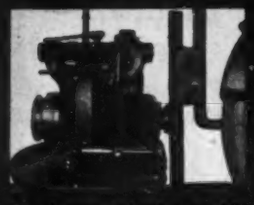
Sellers

Grinding the left side face of a thread tool of great pitch.



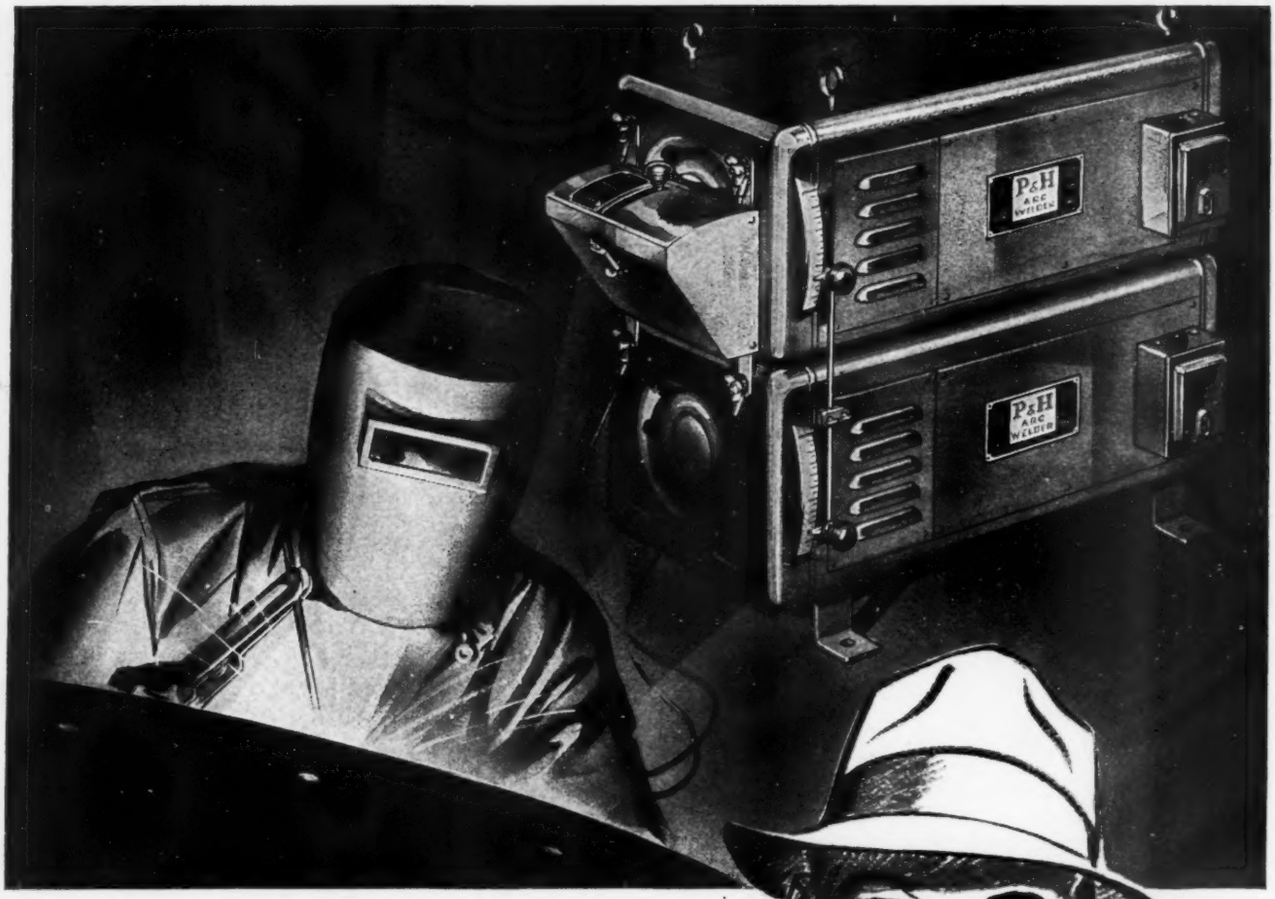
Grinding the left side face of a large V-tool.

Grinding a circular tool.



Supplemental chuck as used for the end face of a hook tool.

Setting a curved face tool by this index.



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One simple control — for single or dual operation — gives you automatic arc response for *any* desired arc length, under *all* welding conditions.

Saves time — by eliminating complex adjustments . . . with surer control for speedier welding.

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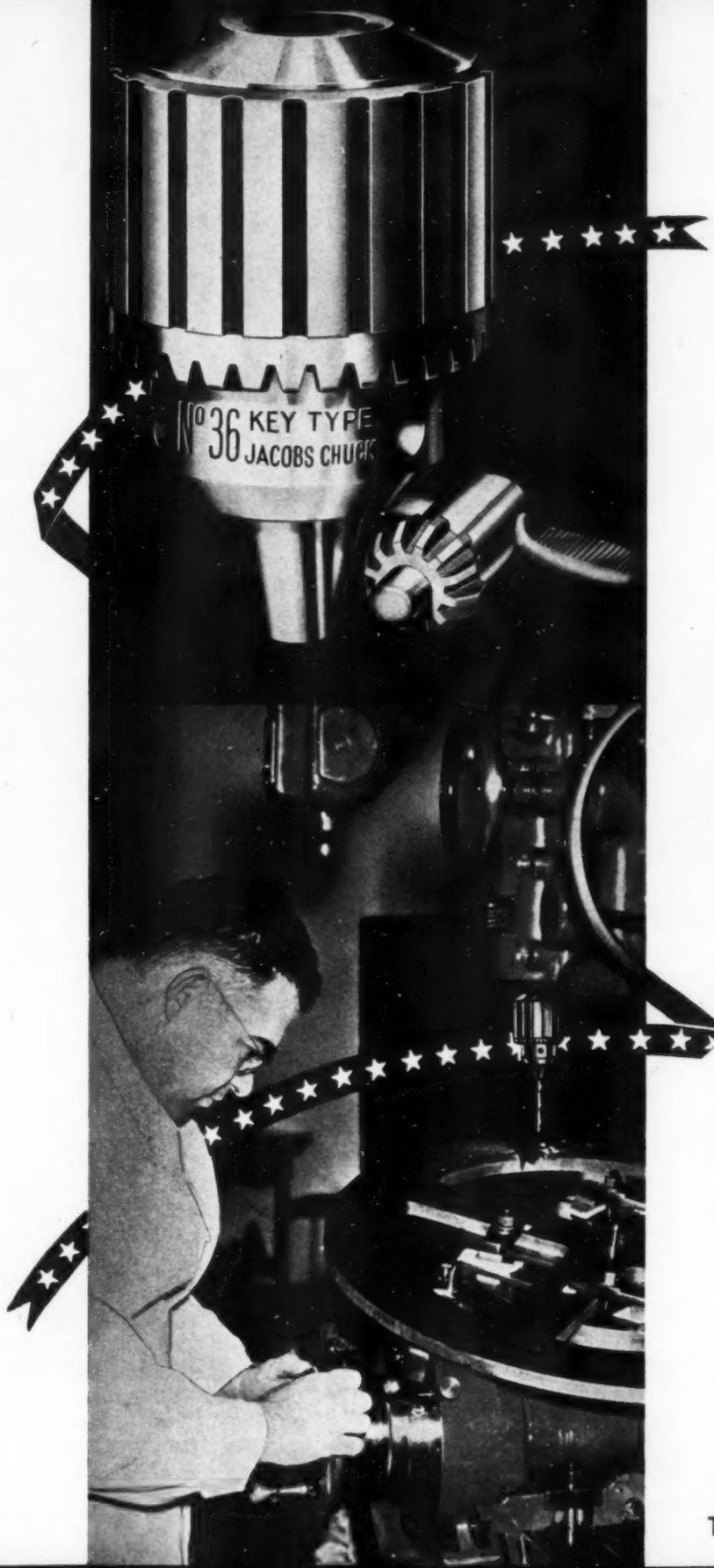

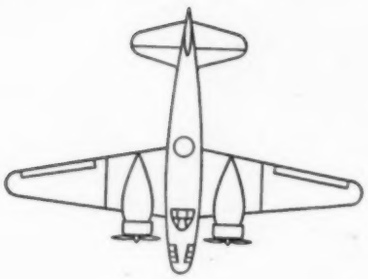

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Measuring Stage Available.

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Accurate within .000008" is a necessity to provide the basic standard of measurements, from which all production starts and all measuring tools and gages used throughout the shop are checked and set. There are large and small sets of our Ultra-Chex lines to suit all requirements.

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Required to inspect the surface of gage blocks, lapped surfaces of all kinds and parallelism of micrometer anvils.

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1" and 2" in 1/1000" and with vernier to 1/10000".

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Our snap gages are made to American Gauge Design Standards. Frames are made of MEEHANITE, a special material chosen because it retains its form. These gages are being used in government arsenals and numerous other plants.

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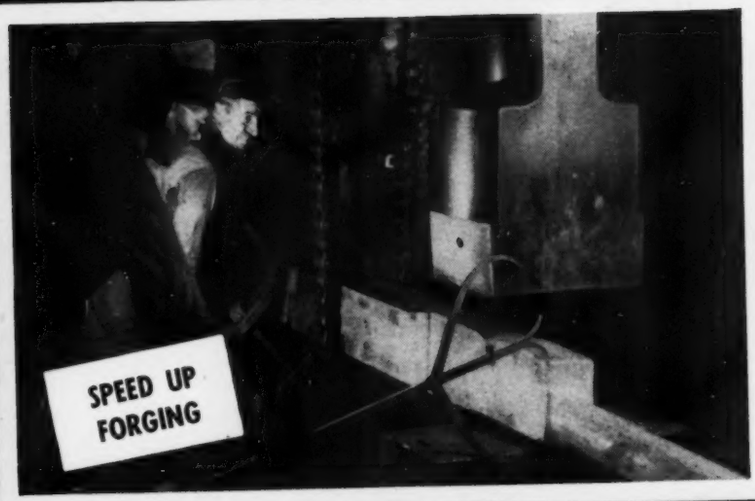

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IF you are working on war orders, we believe we can help you do the enormous job you are facing.

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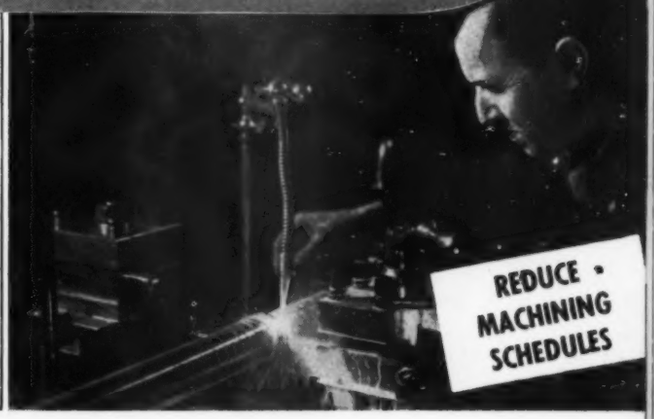
The award of the flag of the United States Bureau of Ordnance and the Navy "E" Pennant for excellence to Carnegie-Illinois, is significant indication of the wholehearted effort that we are putting into the production of steel and steel products essential to the war effort.



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We *like* to be pumped *for* **new ideas**

Shell representatives are being pumped aplenty these days, by purchasing and production executives. These men are looking for new ideas, new methods to increase their production, make machinery and tools last longer . . . for ways to educate green operators.

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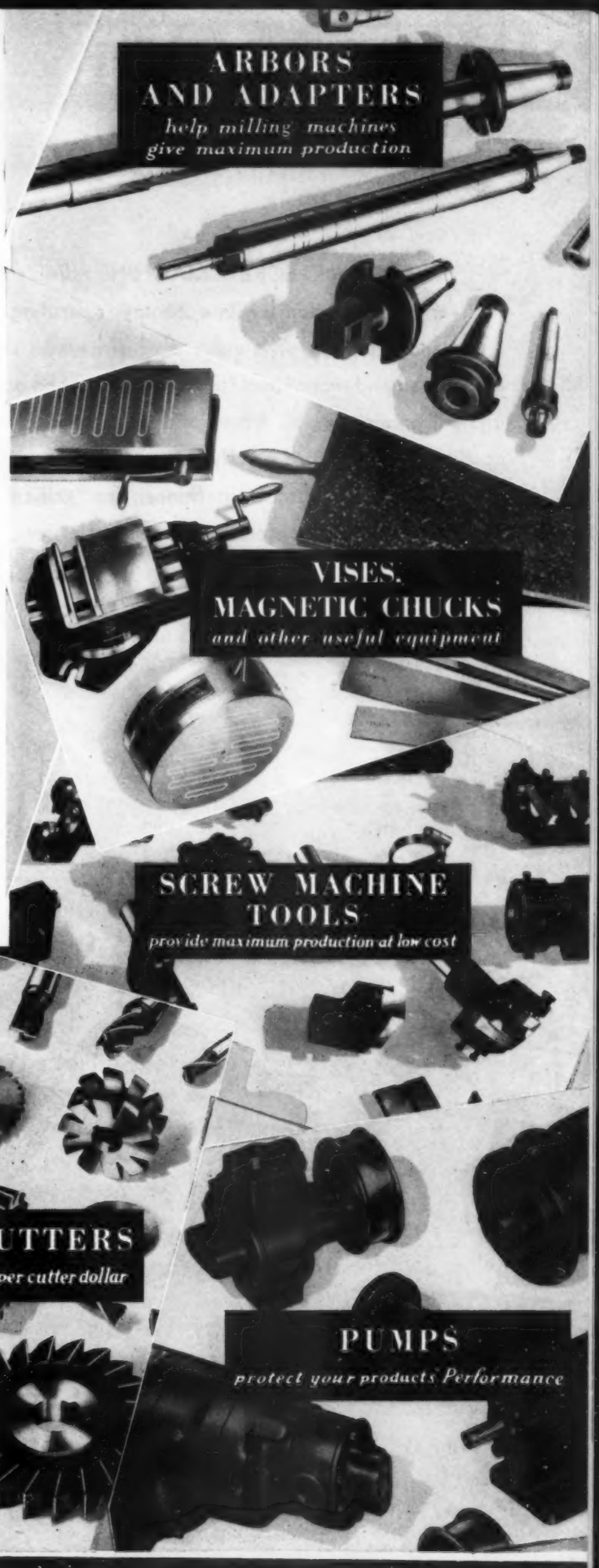

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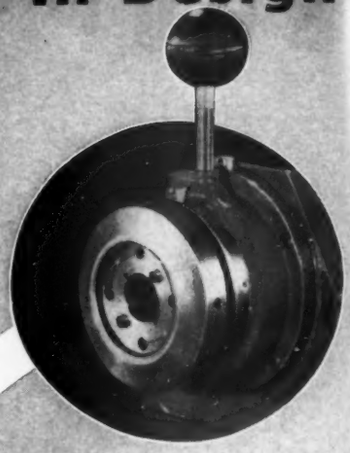
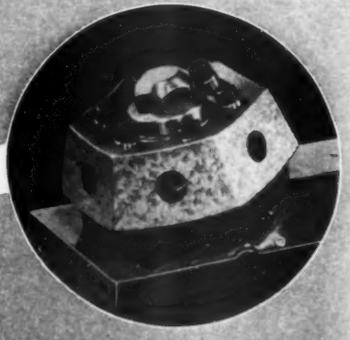
In Performance

THE RIVETT HAND SCREW MACHINE reflects these objectives in production by its economy operating convenience and precision. The value of this machine should be considered and recognized for initial and second operations on small precision work. Many jobs now produced on heavy, costlier units are more quickly set up and finished to closer limits on Rivett hand screw machines. The "critical," larger machines are thus released for more suitable work.

Send for
Bulletin 918A

In Design





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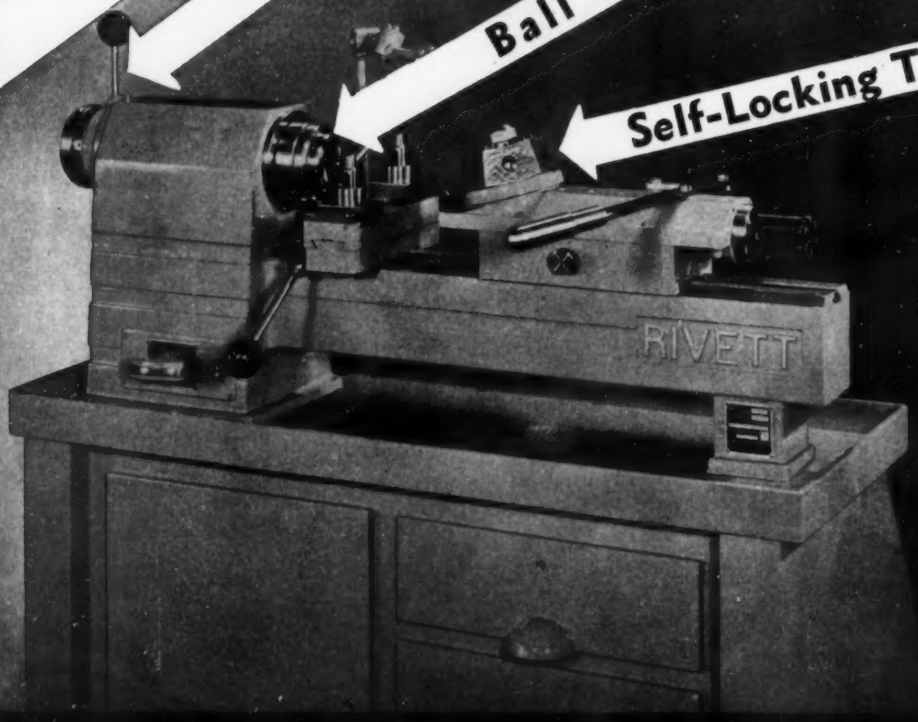

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6" Capacity with Jaw Chucks
6" Capacity with Stop Chucks
1" Capacity with Draw-in Collets
or
1" Capacity with Push-out Collets
8 Spindle speeds 150-2500 r.p.m.
or
8 Spindle speeds 225-3750 r.p.m.

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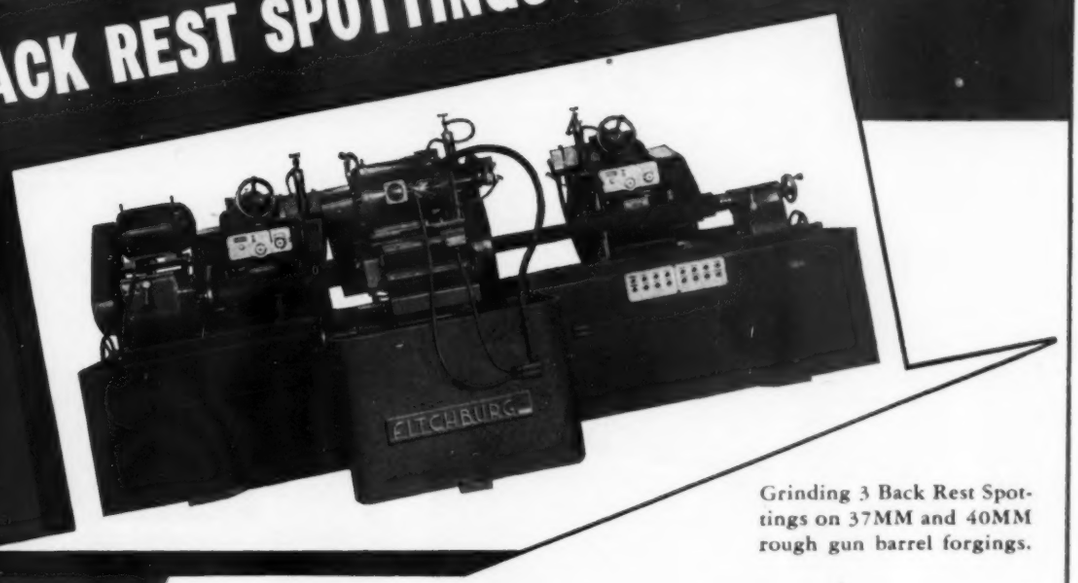
American Optical Company

SOUTHBRIDGE, MASSACHUSETTS

FITCHBURG NOW GRINDS 3 BACK REST SPOTTINGS *at the Same Time*



Grinding 3 Back Rest Spottings on 37MM and 40MM rough gun barrel forgings.

END VIEW OF FITCHBURG TRIPLE HEAD MACHINE

IN speeding the production of heavy gun barrels, shafts, long spindles, etc., Fitchburg Bowgage equipment offers these outstanding advantages on multiple precision grinding work:

1. Performs several operations in the time required for the longest single operation.
2. Eliminates repeated handling.
3. Reduces danger of spoilage by coordinated control of all dimensions being ground at one time.

Fitchburg machines for multiple precision grinding are built with standard Fitchburg Bowgage independent, self-contained Wheel Units. Fitchburg Bowgage heads can be adapted to many uses — either on standard machines or new multiple adaptations for special use.

Production details for gun barrel grinding will be gladly furnished for war production purposes subject to official authorization.

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6″ WORK SURFACE on special Superpower Magnetic Chuck, mounted on ball-bearing work spindle. ¼ HP motor drives work spindle. 7″ x ½″ grinding wheel.

TILTING WHEELHEAD adapts machine to difficult shoulder work, provides ample wheel clearance. An exclusive Taft-Peirce feature.

. . . this time in ROTARY *Surface Grinding*

SHARP ADVANCES in output, quality, and economy of small rotary surface grinding work are accomplished facts wherever this new Taft-Peirce machine is in service. Distinctly different in many features of design, the 6″ Rotary Surface Grinder produces, almost effortlessly, surfaces which are flat to extremely close tolerances. . . . Long service life is underwritten by precision hardened and ground ways and full ball-bearing construction.

Wheel-spindle swivels in a vertical plane from horizontal to 30° below wheel-center. Spindle-block may be adjusted for operations formerly requiring difficult tool set-ups. Freedom from vibration is assured by compact, rigid construction and felt mounting. In sum, the Taft-Peirce 6″ Rotary Surface Grinder establishes new high levels of precision and finish in grinding the plane surfaces of small parts and tools.

THE TAFT-PEIRCE MFG. CO.

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SMALLPEICE MULTI-TOOL PRODUCTION LATHE

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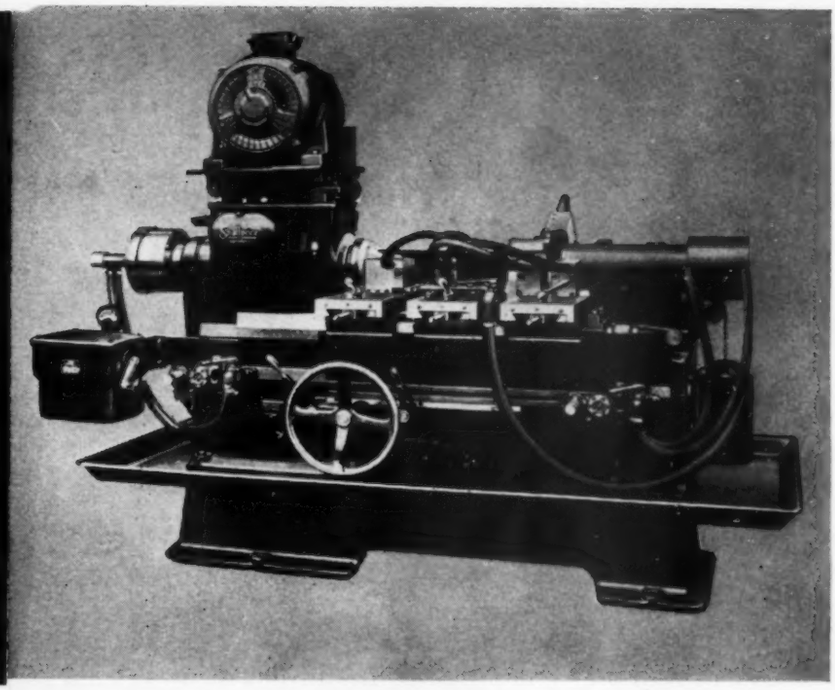
Versatile, Fast and Highly Productive



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Hole through spindle	1¾"	2-5/16"
Spindle speeds—low	52-62	19-258
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high	190-1320	109-1521
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Number of spindle speeds	10	8
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660	84	
530	66	
420	50	
350	45	
280	37	
230	30	

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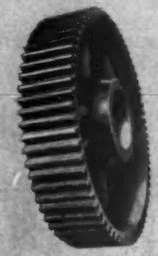

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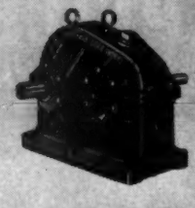

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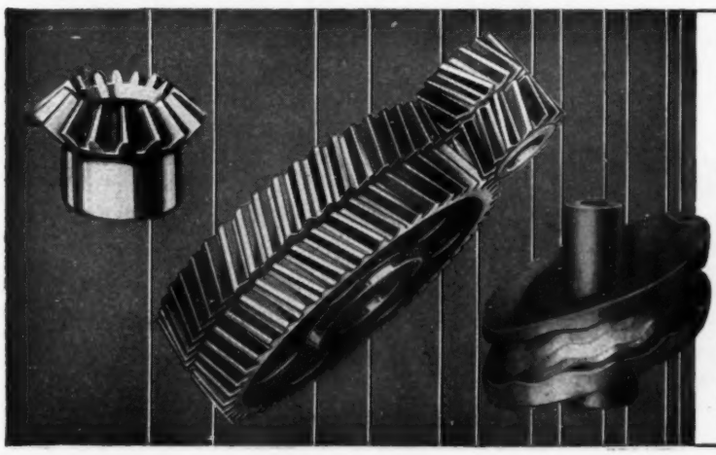

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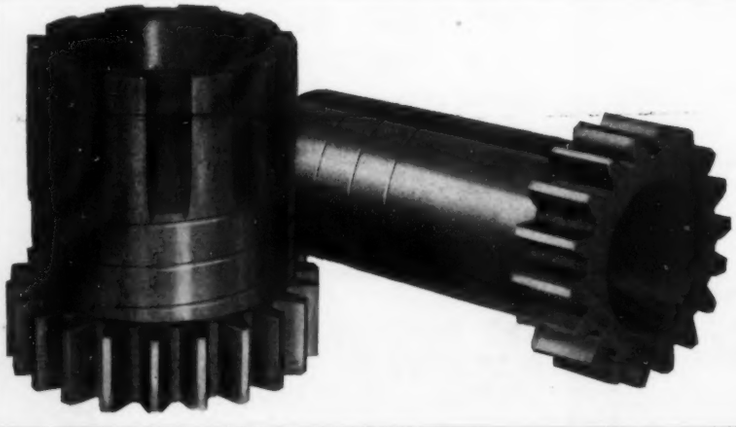

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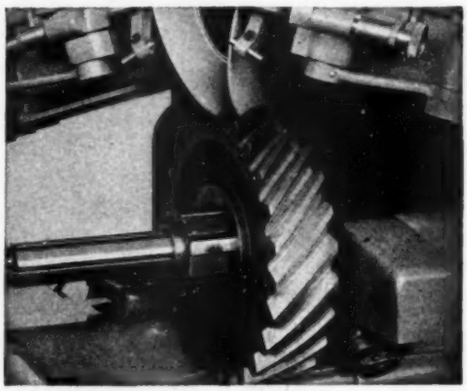

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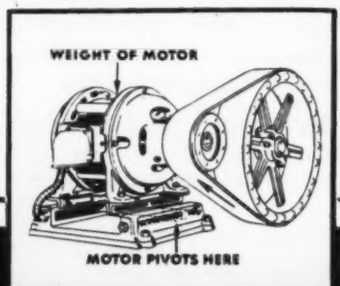

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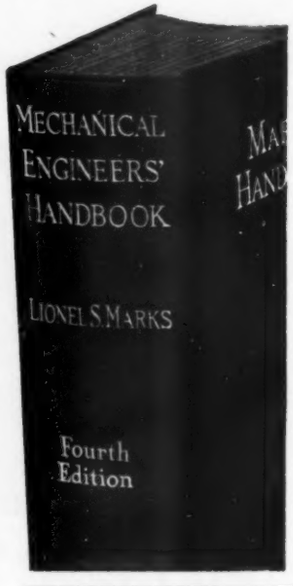

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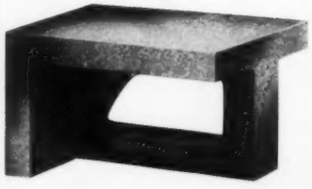
468-4A	8x9x10	52
468-5A	10x10x10	75
468-6A	12x12x12	116
468-7A	18x18x18	260



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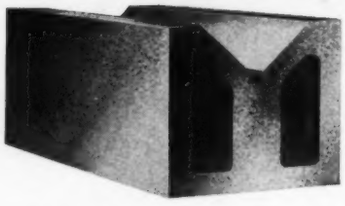

V BLOCKS

Stock No.	Size (inches)	Wt. per pair, lbs.
467-1A	3x2x5	12½
467-2A	4x3x6	25
467-3A	6x6x7	70
467-4A	8x6x8	108
467-5A	8x8x8	120

For holding circular pieces to be milled, ground, shaped, or for inspection work, Lombard hand-scraped V blocks are unexcelled. Sold in matched pairs of identical size. Clamps furnished with blocks as shown below hold securely, prevent slipping.

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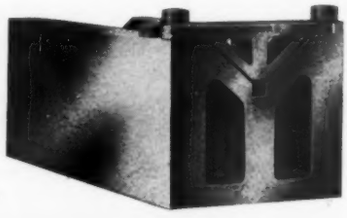
467-2C	4x3x6	30
467-3C	6x6x7	80
467-4C	8x6x8	118
467-5C	8x8x8	135



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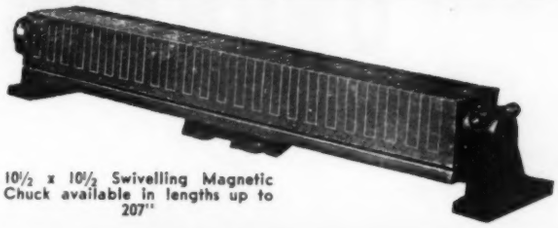

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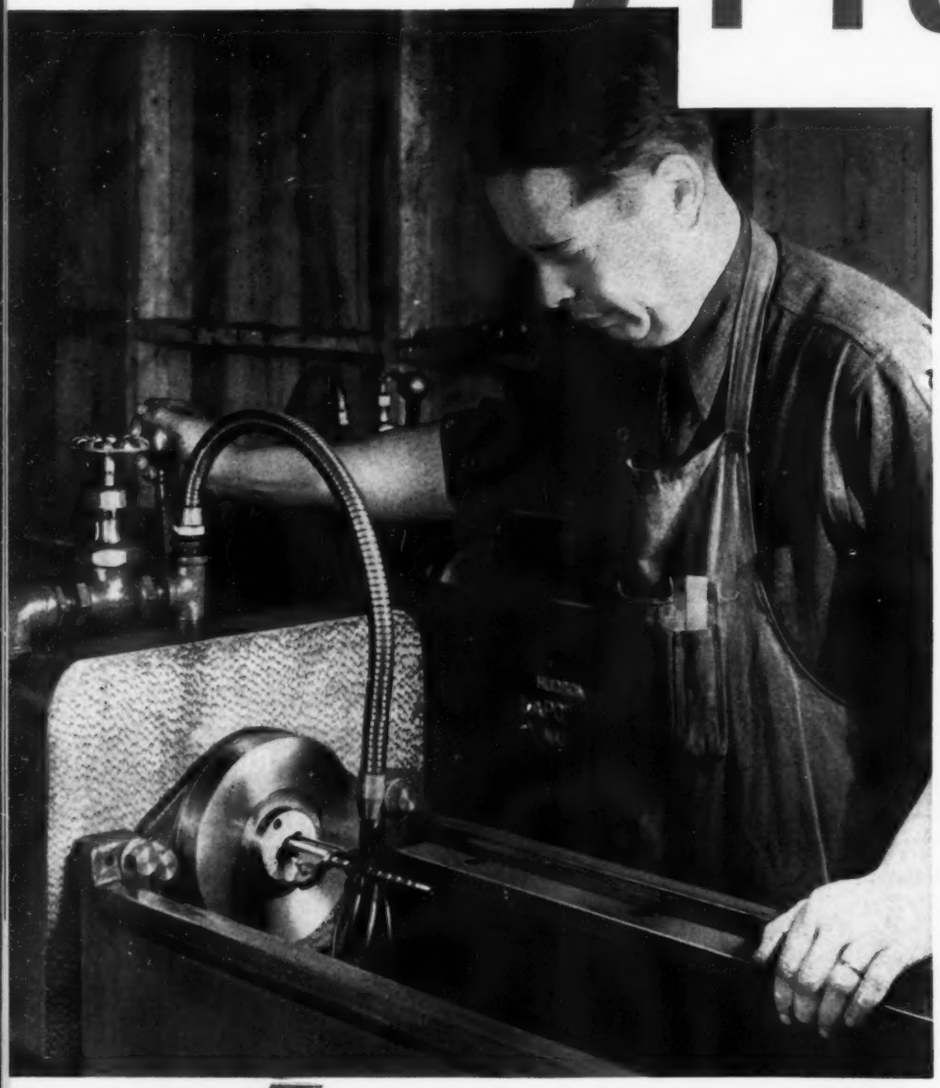

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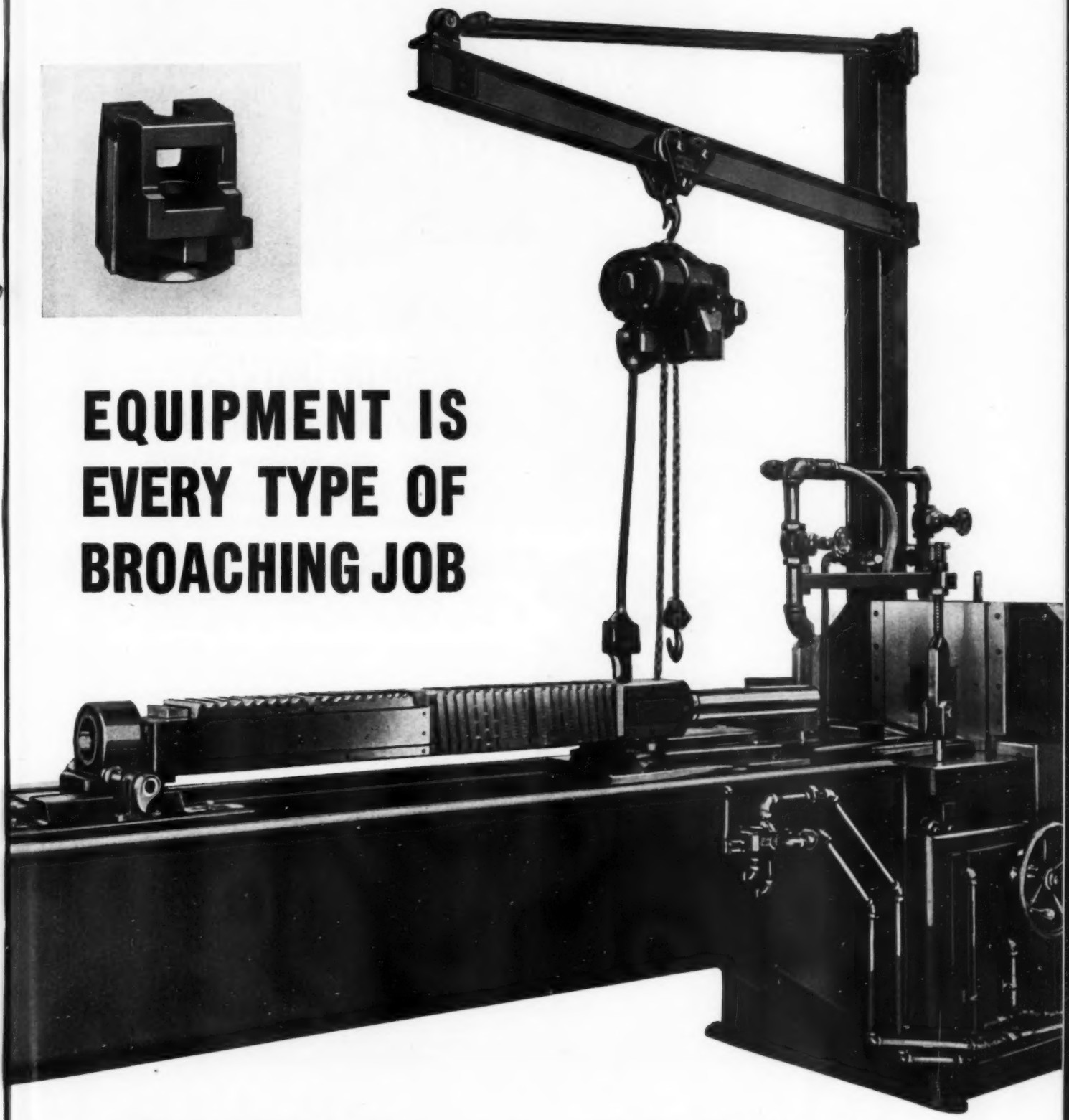

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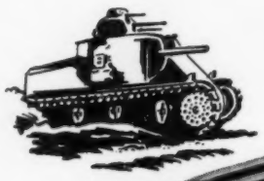

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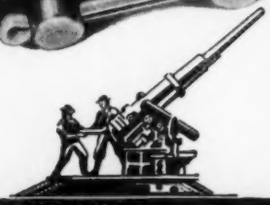

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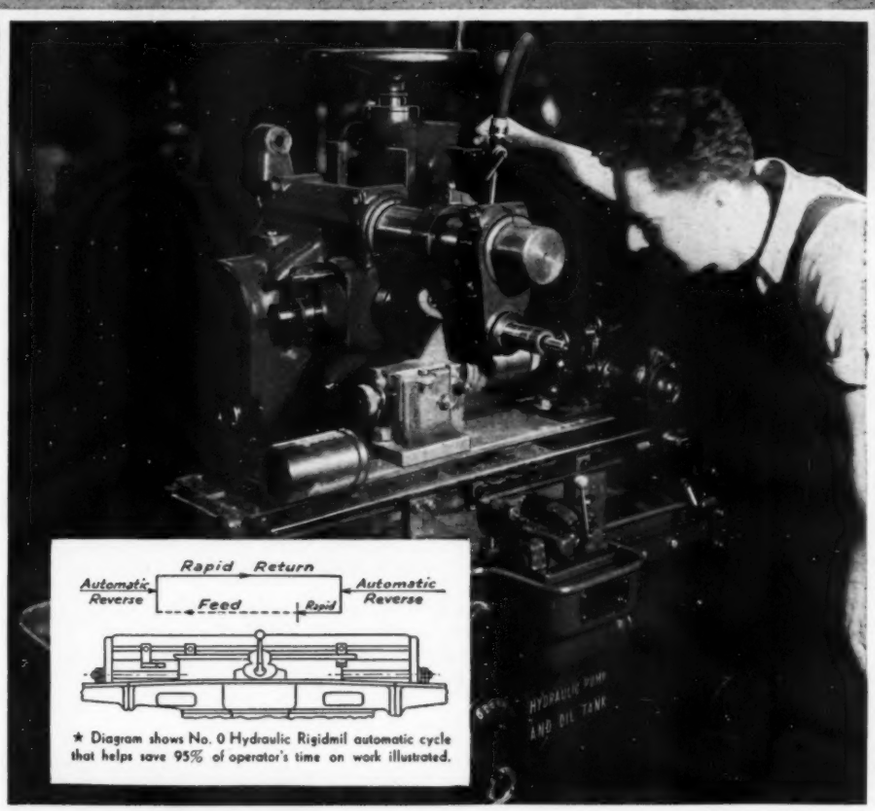

★ Diagram shows No. 0 Hydraulic Rigidmil automatic cycle that helps save 95% of operator's time on work illustrated.

No. 00 Rigidmil

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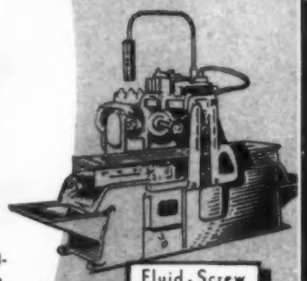

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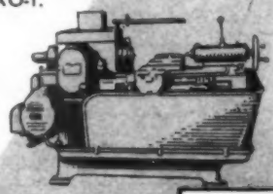
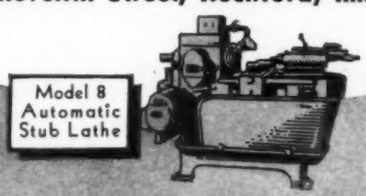
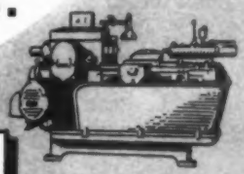


Model 12 Automatic Stub Lathe

Sundstrand Machine Tool Co.
2533 Eleventh Street, Rockford, Illinois, U. S. A.



Model 8 Automatic Stub Lathe



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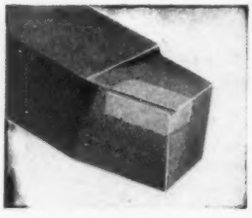

Style No. 12

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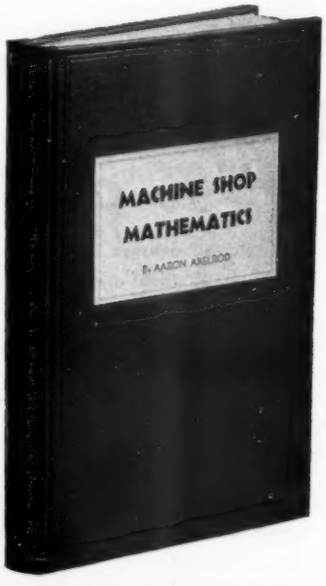

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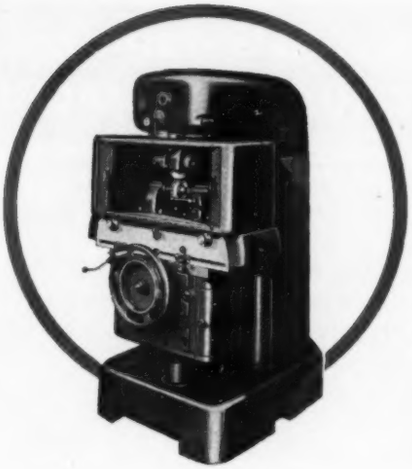

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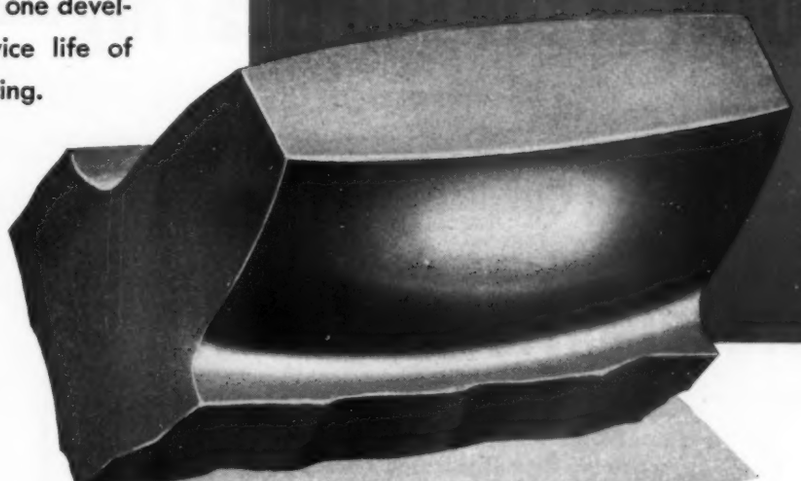

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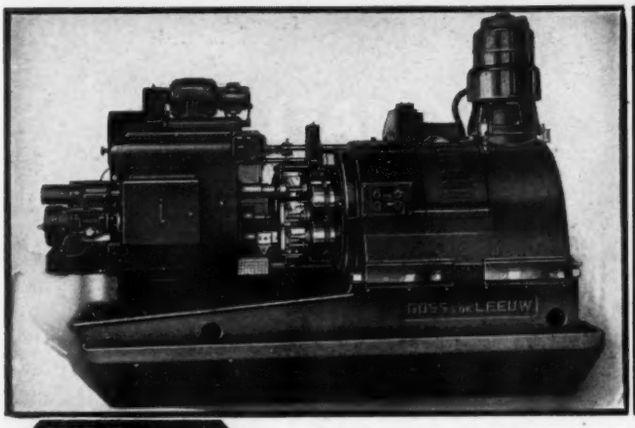

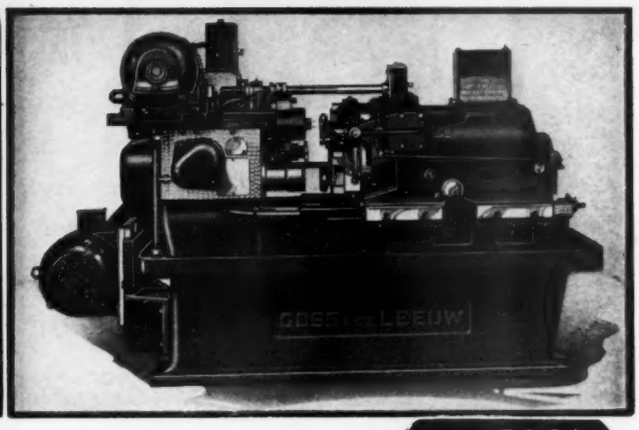

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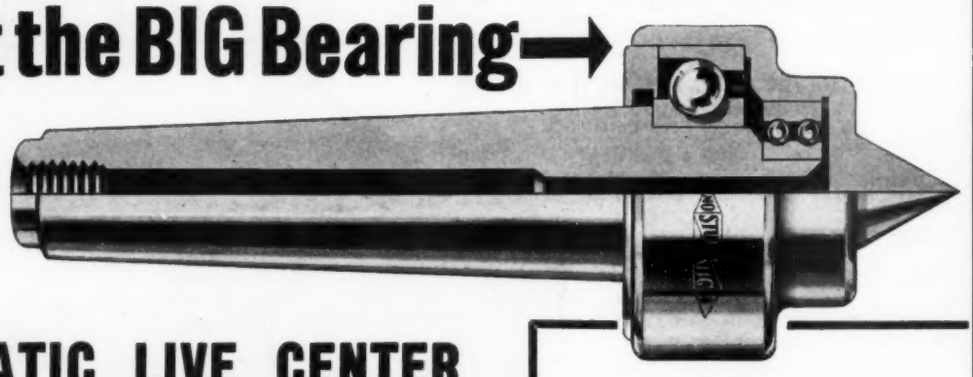

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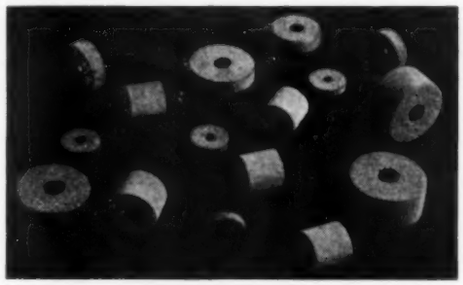

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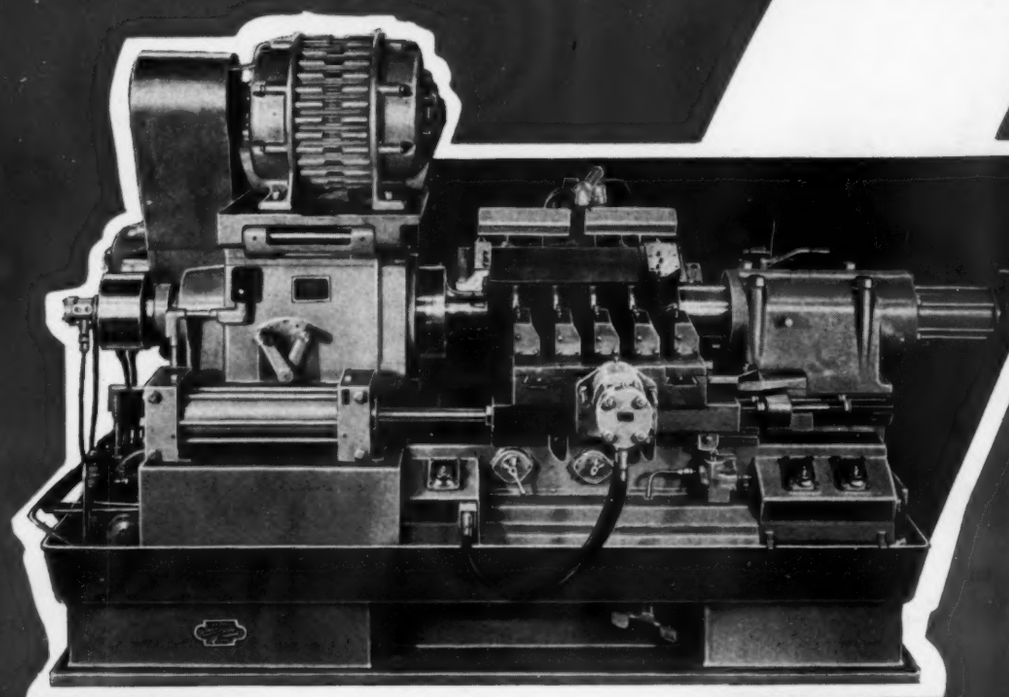
SPARKS SEMI-AUTOMATIC HYDRA-FEED LATHES



Simple operation contributes to speed

Sparks Lathe set up for rough turning operation on a 155 m/m shell. Rough turning time: 69 seconds.

Equipped for automatic operation through the use of hydraulic feeds and hydraulically operated duplex brake and clutch, the SPARKS LATHE is fast and accurate on shell production as well as easy to operate.

Procedure is simple. The shell forging is inserted in lathe and tailstock live spindle traversed hydraulically to locate shell on mandrel, at which time the spindle starts automatically through hydraulically operated clutch.

Carriage with slide controlled tools is moved hydraulically until outside of shell is completely turned. Simultaneously, rear slide tools are moved hydraulically into shell for facing base end for cutting off open end to length.

On completion of turning operation, pilot valve is rotated automatically by trip dog which puts feeds in rapid traverse to return carriage and rear slide to starting positions.

Hydraulically operated brake stops spindle automatically. Quick recovery of turned shell is made possible by operation of foot-treadled valves on floor which release pressure on expanding mandrel and traverse the tailstock spindle.

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New Catalogs, Booklets, Bulletins

METAL-WORKING EQUIPMENT

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2 DOALLS—Continental Machines, Inc., Minneapolis, Minn. 78-page catalog describes Doall machining process with large illustrations showing machine's operation on various armament items at plants. Describes advantages and use of three-dimensional production, short-run stampings, special fixtures for handling production jobs, continuous filing on production jobs, special work and contour drawing.

3 PIPE THREADING AND CUTTING MACHINES—Saunders Machine & Tool Corp., Yonkers, N. Y. 24-page illustrated booklet 101M has specifications and general descriptions of large line of machines. Valuable to users.

4 GRINDING AND POLISHING MACHINES — Production Machine Co., Greenfield, Mass. 4-page illustrated folder on Type R-multi-purpose grinding and polishing machine gives story on machine with specifications and action photos showing use as disk grinder, and for polishing, surfacing and buffing.

5 NOSE GRINDERS—Fitchburg Grinding Machine Corp., Fitchburg, Mass. 4-page folder gives data on special application of Bowgage self-contained automatic grinding wheel unit for speeding war production on armor piercing shells. Has illustrations, diagrams and specifications.

6 PROFILE GRINDING MACHINE—Miller Engineering Machine Co., Newark, N. J. 4-page illustrated folder describes Model "A" designed for tapers and oliptical curves. Illustration shows enlargement of spindle mechanism and operation.

7 METAL WORKING MACHINES—Ex-Cello Corp., Detroit, Mich. 24-page book has large illustrations showing how equipment has been used in war production, and its operation in various plants. Manufacturing operations in Ex-Cell-O plant described in detail. Includes data on boring machines, thread grinders, cutting tools and other divisions of company. Interesting company study in war times.

8 THREAD MILLERS—U. S. Machine Tool Manufacturing Corp., Terre Haute, Ind. 4-page folder describes automatic precision thread miller for any thread system 5 to 40 thousands of an inch on both internal and external threading. Illustrations and diagrams describe operations and specifications in detail.

9 VERTICAL BORING MILLS—Production Machinery Development Co., Detroit, Mich. 9-page catalog gives specifications on Verti-Hydra-Matic which has vertical chuck, is hydraulically operated and fully automatic. Series of eight illustrations show machines from all views with and without guards.

10 TURRET LATHES—G. M. Diehl Machine Works, Wabash, Ind. 6-page illustrated folder describes No. 2 turret lathe with specifications and diagrams showing operations.

11 METAL AND WIRE FORMING MACHINES—A. H. Nilson Machine Co., Bridgeport, Conn. 4-page bulletin 75A describes automatic metal and wire forming machines with illustrations and specifications. Typical examples of work and diagrams illustrating placement of working members shown.

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TOOLS AND ACCESSORIES

12 TOOLS—Scully Jones & Co., Chicago, Ill. 384-page illustrated, book-bound tool engineering manual contains wealth of information and technical tooling data, covering standard and special high production tools. Special, convenient indexing system used. Picture index aids location of tools called by different names. 500 photographs display full line of standard and special tools, and tooling applications. 560 line drawings and 400 charts give information and dimensions on standard tools and engineering data. A complete manual in every way, invaluable to key man on tools. (Editor's note: due to paper shortage, please do not request this unless you have real and ready use for book. Include complete information as to title and company affiliations on post-card.)

13 COLLET CHUCKING FIXTURES —Zagar Tool, Inc., Cleveland, O. 4-page folder illustrates and describes collet chucking fixture for faster holding and indexing. Advantages described, illustrated and diagrammed for milling, turning, tapping and drilling. Prices given with special ten day free trial offer.

14 TAPS—Threadwell Tap & Die Co., Greenfield, Mass., 75-page illustrated Catalog 41, gives descriptions, specifications, prices and all necessary data on complete line of taps, dies, screwplates, die boxes, tap wrenches, counterbores, and keyway cutters. Valuable and handy manual.

15 PRECISION EQUIPMENT — Challenge Machinery Co., Grand Haven, Mich. 12-page illustrated catalog describes and lists specifications on lapping plates, surface plates, bench plates, work benches, straight edges, parallel blocks, angle blocks, V-blocks and cut-off machines.

16 OPTICAL COMPARATORS — Portman Machine Tool Co., Mt. Vernon, N. Y. 6-page illustrated folder describes machine for comparing parts to patterns instantly by viewing highly magnified contours. All necessary data given; illustrations and diagrams show construction and use.

17 COLLET CHUCKS—Erickson Steel Co., Cleveland, O. 4-page illustrated folder describes and diagrams with complete specifications, uses, advantages, construction and other interesting points. Prices on separate items and collet chuck sets.

18 INDUSTRIAL X-RAY — General Electric X-Ray Corp., Chicago, Ill. 34-page catalog describes applications of X-ray in examination and inspection of castings and welds with complete description of use, and innumerable photographs showing results of X-ray utilization. Also, 20-page catalog, 7A-560 on XRD units with applications in various industries. Describes unit in detail.

19 GRINDING GAGES—Acro Tool and Die Works, Chicago, Ill. Illustrated folder on master grinding gage for positioning tools at proper angle while being ground on surface grinder. Gives advantages of increased machine production, saved skilled man-hours, and less rejects. Gives guarantee, and prices.

20 CHUCKS — Westcott Chuck Co., Oneida, N. Y. 24-page illustrated Catalog 540, gives specifications, prices, and all necessary data on line of chucks for all uses. Handy reference.

21 AIRCRAFT TOOLS—Aero Tool Co., Burbank, Calif. 28-page spiral bound, illustrated catalog describes construction, application, sizes, features, etc., of rivet sets, polished flat sets, flush sets, squeezer sets, squeezer yokes, bucking bars, plomb bob, dimple dies and punches, dimpling tools, cutters, mills, spot facers, bushing indicators, etc. Invaluable tools in aircraft and aircraft parts manufacture.

22 TOOLS—Plomb Tool Co., Los Angeles, Calif. 116-page illustrated catalog 19 on Plomb tools for all operations, complete with prices. Handy manual.

23 ELECTRIC GAGING—General Electric Co., Schenectady, N. Y. 12-page illustrated booklet GES-2543 tells of eleven instances where savings in time, money and improved quality have resulted from application of sensitive but sturdy electric gaging equipment. Describes strain gage, pressure gage, film thickness gage, eccentricity gage, etc., with applications for each.

24 CHUCK CYLINDERS AND VISES —Hannifin Manufacturing Co., Chicago, Ill. 4-page bulletin 58 on pneumatic rotating type cylinders for chuck operation has complete dimensions and specifications. Also bulletin 59 on pneumatic bench, drill press and milling machine vises and diagrams with illustrations and specifications.

25 VISES—Graham Mfg. Co., Inc., East Greenwich, R. I. Illustrated folder gives complete specifications, prices on machine vises, knurl holders and drill speeders. All necessary data for ordering.

26 BROACHES — East Shore Machine Products Co., Cleveland, O. 4-page folder on Glenny adjustable-expansion broach for simplifying cutting of keyways, has illustrations, diagrams, prices and specifications for tools.

27 DIAL GAGES—Lombard Governor Corp., Ashland, Mass. Folder describes line of dial gages with illustrations and specifications for readings up to .0001 inch.

PLANT-SERVICE EQUIPMENT

28 DUST COLLECTORS — Edward Blake Co., Newton Centre, Mass. 4-page illustrated folder describes Filtaire, a portable dust collector with 101 industrial uses. Describes advantages and plant problems that it overcomes. Diagrams show operations. Specifications given.

PARTS AND MATERIALS

29 RODS FOR SCREW MACHINE PRODUCTS—American Brass Co., Waterbury, Conn. 24-page illustrated book, "Anaconda Free Cutting Brass Rods," describes use for screw machine products. Work samples given, advantages, engineering data for determining cost, time and other production factors. One section devoted to balancing material against cost of production. An invaluable manual to all interested in screw machine products.

30 GEARS—General Electric Co., Pittsfield, Mass. 24-page illustrated catalog, "Silent Gears," describes Fabroil gears showing actual manufacture with large illustrations and giving installation data and charts of dimensions of gear blanks. Valuable to potential users.

31 MATERIALS—A. M. Byers Co., Pittsburgh, Pa. 60-page general catalog on line of wrought iron, tubular and hot rolled products, steel tubular products and alloy steels, gives engineering data on wrought iron steel, etc. Valuable general material and complete listing of line of products they supply with necessary dimensions.

32 COPPER, BRASS AND BRONZE— Revere Copper and Brass, Inc., New York, N. Y. 30-page book "Revere Weights and Data," gives valuable engineering data of all kinds including millimeters and equivalents, areas of circles, weight conversion factors, weights for various materials and other information. Handy reference.

33 DILECTO — Continental-Diamond Fibre Co., Newark, Del. 42-page illustrated folder on Dilecto, a laminated phenolic plastic. Gives complete data on users, composition, machining and all necessary information for use.

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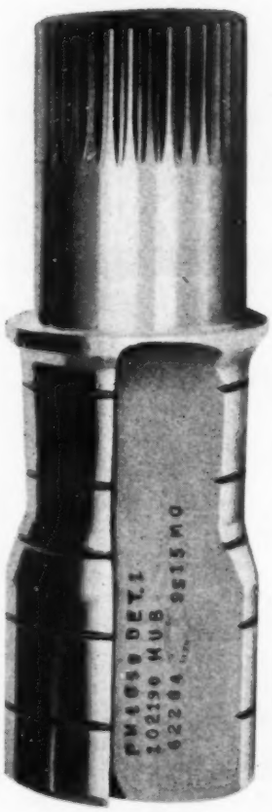

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DURING the First World War National Cleveland was called upon to produce cutting tools in unheard-of quantities and we were equal to the task. Today we are surpassing those performances and are striving for even greater production month after month. The entire facilities of this plant—one of the largest tool plants in the country—is devoted to the winning of this war. If you are engaged in war production you are entitled to a proper proportion of our output. National Cleveland cutting tools are on the "critical" list and we are doing our best to meet the demand.

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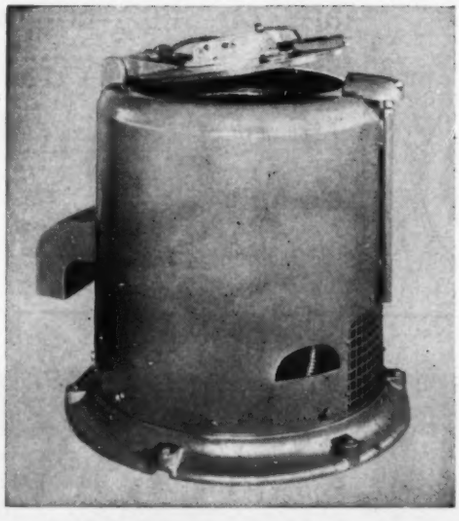

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In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

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It will pay to investigate the advantages offered by Barrett Centrifugal Dryers on your work.

Full Details of the Barrett Cyclone Dryer Sent Promptly on Request

THE LEON J. BARRETT CO., WORCESTER, MASS.
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Accuracy is basic...

1. IN AMERICA'S WAR EFFORT — 2. IN ABRASIVE SURFACE GRINDERS

ACCURACY IN THE TOOL ROOM—Accuracy in the tool room is essential to all machine production. Interchangeability of parts, the foundation of mass production, is impossible unless tools and dies are accurately finished. Hundreds of Abrasive No. 1½ Surface Grinders are on active duty in tool rooms of plants in the thick of war production. . . . Operators prefer them, first, because they are accurate and then because they are easy to operate and have an unusual capacity, 15 x10 x12" high. . . Management likes these hand operated grinders because they are less expensive in first cost, cost of operation, and cost of upkeep. Write for Catalog No. 1½.

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ACCURACY IN MACHINE TOOL BUILDING — Only an accurately built machine can produce accurate work. Illustration shows an Abrasive No. 34 Surface Grinder with circular grinding attachment in our own shop helping to finish parts for Abrasive Grinders. This built-in-accuracy has been responsible for the success of Abrasive Surface Grinders and the real reason why they have been ordered by so many other machine tool builders—both before and during this emergency. Write for Catalog No. 34.

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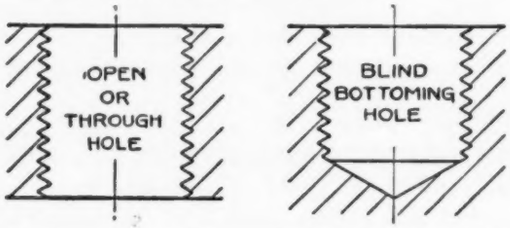
Hole Hints FOR TAPPERS

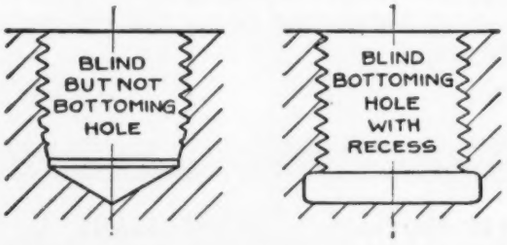
SLOW production, rejected parts and broken taps, are often due to poor preparation of holes for tapping operations. Here are some points which will help you to prevent costly losses.

Always keep in mind that good clean drilling and a reasonable size maintenance are keys to better, faster tapping and with less strain on the tap and less power consumption.



For open or "through" holes in steel, use "*Gun*" or Plug Taps; stick to Plug Taps for gray cast iron and non-malleables; for cast iron containing steel, use "*Gun*" Taps. For blind or bottoming holes, use a Bottoming Tap if the full length of the hole is to be threaded. Always be sure the drill chips are removed from the bottom of the blind hole before you start to tap.

A 100% thread depth requires 3 times the power necessary to tap a 75% thread, but is only 5% stronger. A nut with 50% thread depth will break its bolt before the thread will strip. Good manufacturing practice should provide a depth of thread not less than 62% to 75% (depending on the size) and not more than 83⅓% of the basic thread depth. Remember these facts and you will not make your drilled holes too small.



The tougher and harder the material, or the deeper the tapped hole, the smaller the thread depth you can safely adopt.

Punched holes in thin sheet metal tend to cause taps to "load" and break. See that punched holes are not too small. Same with cored or forged holes in casting or forging. It pays to drill them.

As a guide to the most practicable drill size for all threads, consult any standard tap drill chart. We will gladly send you one on request.

This is one of a series of advertisements published by the Greenfield Tap and Die Corporation to help users get greater production from their taps. The entire series is now available in booklet form. Send for a copy.

GREENFIELD TAP AND DIE CORPORATION • GREENFIELD, MASSACHUSETTS

DETROIT PLANT: 2102 West Fort St.
WAREHOUSES in New York, Chicago and Los Angeles
In Canada: GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

GTD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

Announcing

SERIES "RS"

THE NEW NAMCO COLLAPSING TAP

with

- ✓ Quick and positive opening for close-to-shoulder threads.
- ✓ Fine diametric adjustment and ground thread chasers — for high precision work.
- ✓ One design: for stationary spindle machines — as shown; for revolving spindles — without resetting handle and trip ring.
- ✓ Five sizes — 1-1/4 min. to 2-13/16" max. with blade chasers. Larger sizes up to 5" with circular ground thread chasers.

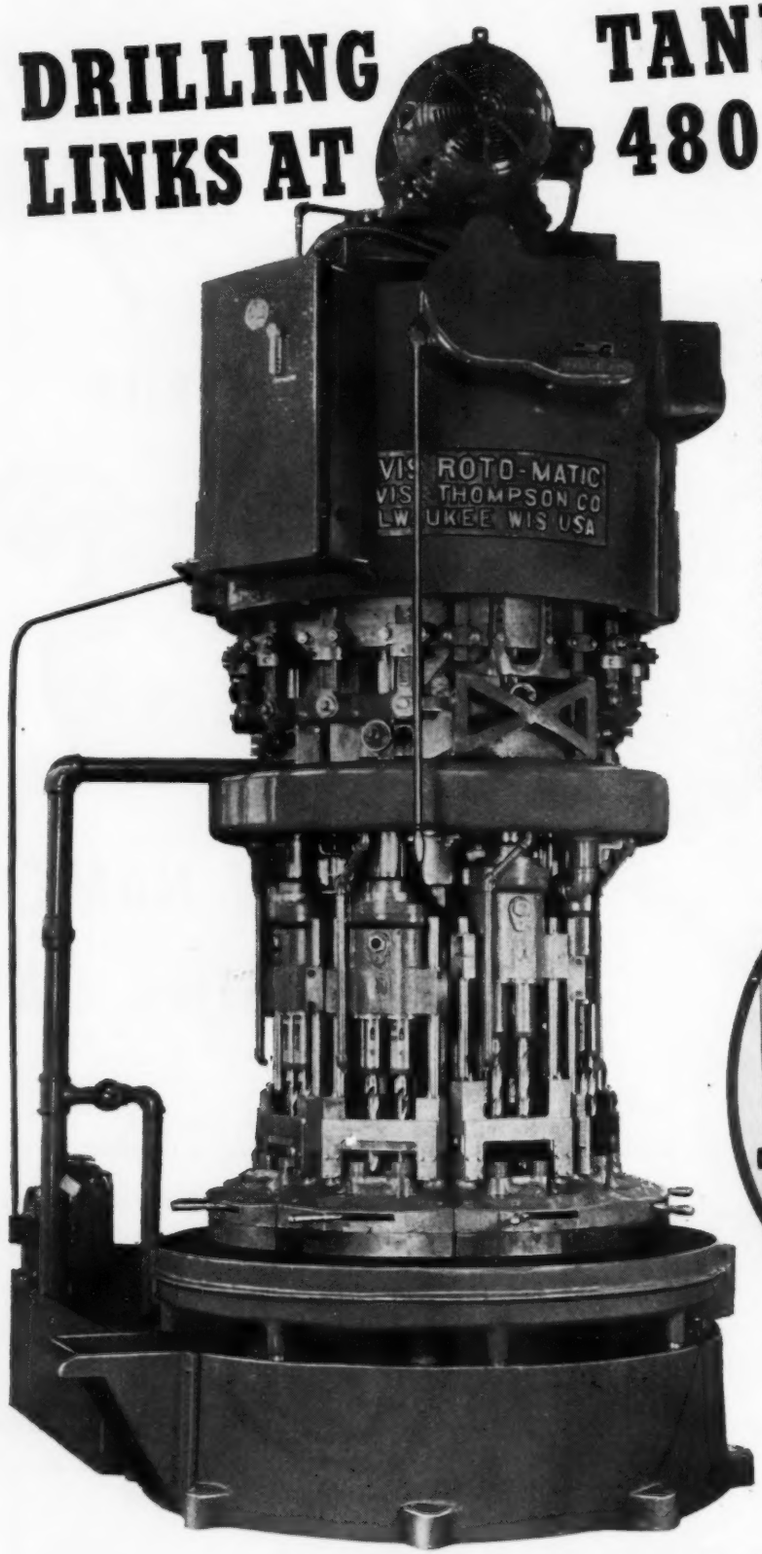
COMPANIONS IN PERFORMANCE WITH NAMCO CIRCULAR CHASER DIE HEADS

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

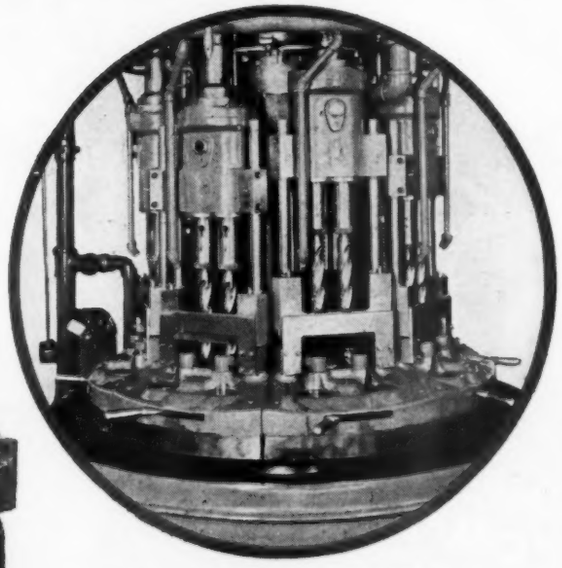
ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

DRILLING TANK TRACTOR LINKS AT 480 PER HOUR



PACED to the swift tempo of today's war production this Davis & Thompson Eight Spindle Vertical Driller turns out 480 tank tractor connecting links per hour . . . Loading is simplified by special holding fixtures and drilling is automatic, with drill heads actuated by a cam. To maintain the high operating speed, a coolant is supplied in constant volume by a 3 h.p. pump. This machine is adaptable to many drilling operations through the use of specially constructed fixtures . . . This Vertical Driller is further evidence of the capacity of Davis & Thompson Co. to develop special machines to meet the ever-changing demands of wartime production . . . Write for information about the entire Davis Rotomatic Line.

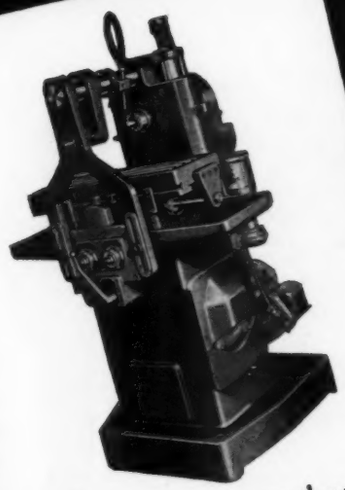
DAVIS & THOMPSON CO., Milwaukee, Wis., U. S. A.



Close-up of drilling unit of Davis-Rotomatic Eight Spindle Vertical Driller, shown completely at left.

DAVIS ROTOMATIC

HIGH PRODUCTION MACHINERY



No. 1-8

8″ table travel . . . 25″ by 9″ table . . . hydraulic table feed . . . simple automatic cycle.

No. 2-20

20″ table travel . . . 42″ by 12″ table . . . full automatic hydraulic table feed.

No. 1-14

32″ by 9″ table . . . 14″ table travel . . . hydraulic table feed . . . full automatic cycle.

EVERY ONE A STAR!

Are you looking for Milling Machines that mill accurately, efficiently, day in and day out without trouble . . . milling machines that take your War jobs out of the tool room and put them on a production basis? *You need Kent-Owens Milling Machines!*

Rugged . . . Simple . . . Efficient . . . they provide the advantages and features that practical shop men demand. They've got the guts to do the tough jobs RIGHT! Send for latest bulletins. Contact your nearest representative or write us direct. Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS

for Milling Machines

THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corporation
BUFFALO
Don W. Patterson
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Neff, Kohlbusch & Bissell
DALLAS
Hamilton-Huster Machinery Co.
DAYTON
Gosiger Machinery Company
DETROIT
A. C. Haberkorn Machinery Co.
GRAND RAPIDS
Joseph Monahan
HOUSTON
Oliver H. Van Horn Co., Inc.
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Oatis-Booth Machinery Co.
LOS ANGELES
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TORONTO
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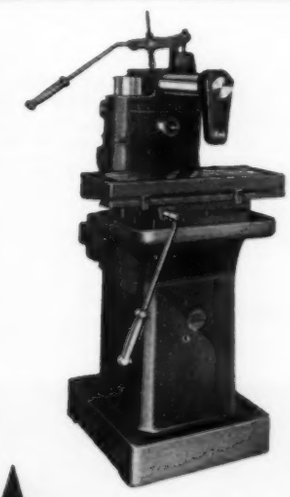
F. F. Barber Machinery Company

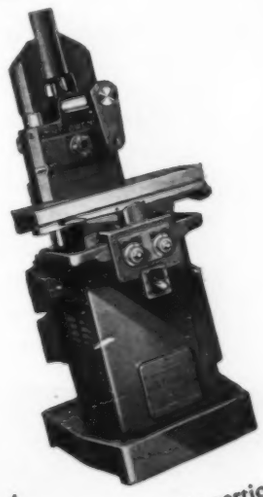
No. 2-RV

3 H. P. . . hand feed to table and head . . . spindle speed range 100 to 1200 R. P. M.



No. 1-M

Hand feed to table and head . . . 25″ by 9″ table . . . 1 H. P. . . head counterbalance is adjustable.



No. 1-V

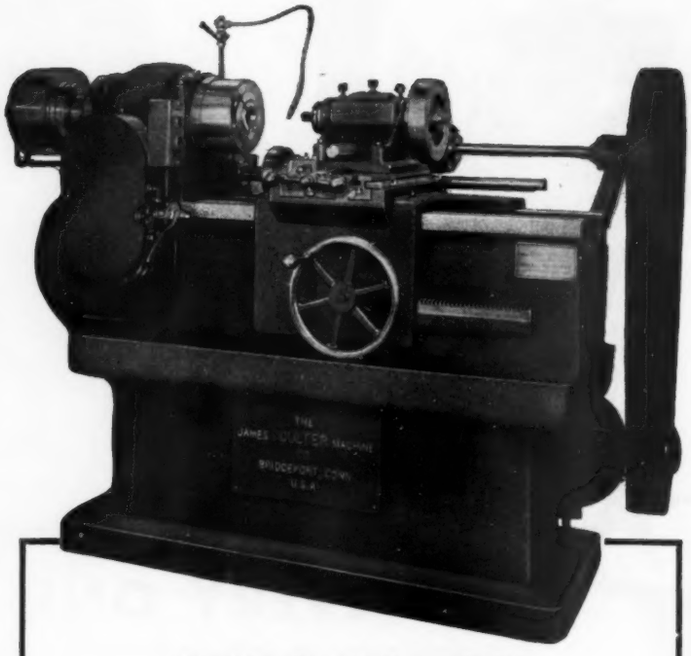
Hydraulic vertical head . . . 5½″ head travel . . . 2 . . . 9″ table.

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

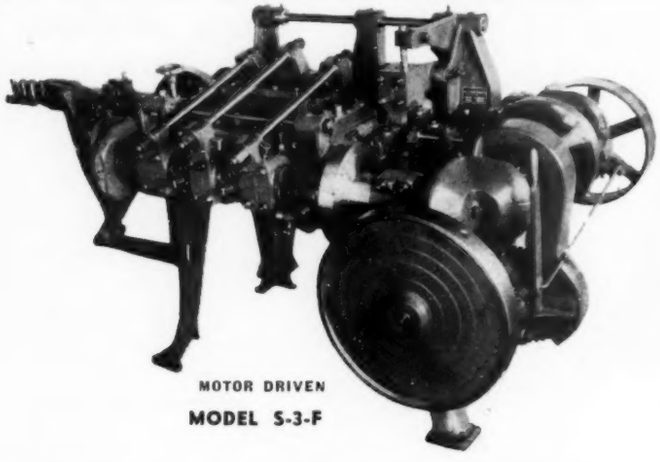
Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

STEP UP PRODUCTION OF FORMED PARTS



MOTOR DRIVEN
MODEL S-3-F

. . . with the
NILSON AUTOMATIC METAL and WIRE FORMING MACHINES

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

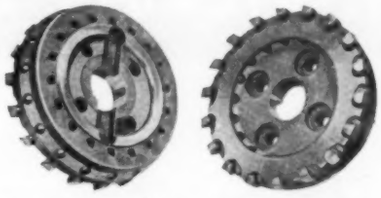
3 Essentials FOR THE WAR EFFORT

BUY THESE FIRST

FOR VICTORY

BUY UNITED STATES SAVINGS BONDS AND STAMPS

LOOK INTO THESE NEXT



LOVEJOY MILLING CUTTERS

with positive-locking blades

Lovejoy mills are designed to withstand the abuse of your 24-hour production schedule. Yet they require minimum power for coarse feeds and high speeds — a minimum of down-time for sharpening — a minimum of blade waste at each resharpening. Maximum use is assured from each blade because of Lovejoy's positive-locking device — maximum accuracy and economy result.

BY MAILING THIS TODAY

Please send me my copy of your 24-page catalog No. 26 describing Lovejoy Milling Cutters in complete detail. (No obligation, of course.)

NAME_____ TITLE_____

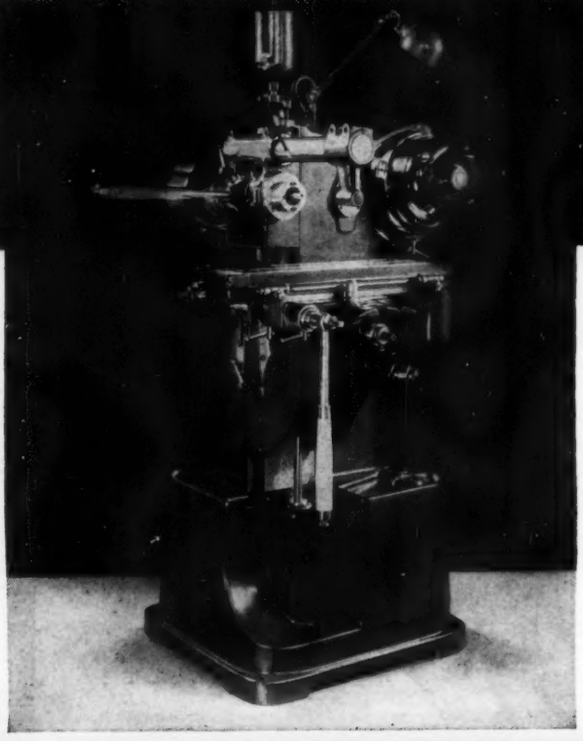
COMPANY_____

STREET_____

CITY_____ STATE_____

A.M.

LOVEJOY TOOL CO., INC., SPRINGFIELD, VERMONT, U.S.A.



THE NICHOLS HAND MILLER

» A modern, convenient machine for the volume production of accurate parts . . . .

In the "NICHOLS", the usual features of the hand miller have been combined with a ruggedness of design and construction which makes it a truly production machine tool offering high cutting speeds, maintained precision and long life. A wide variety of operations can be handled at top speed and reduced cost as compared with the same work produced on larger slower machines.

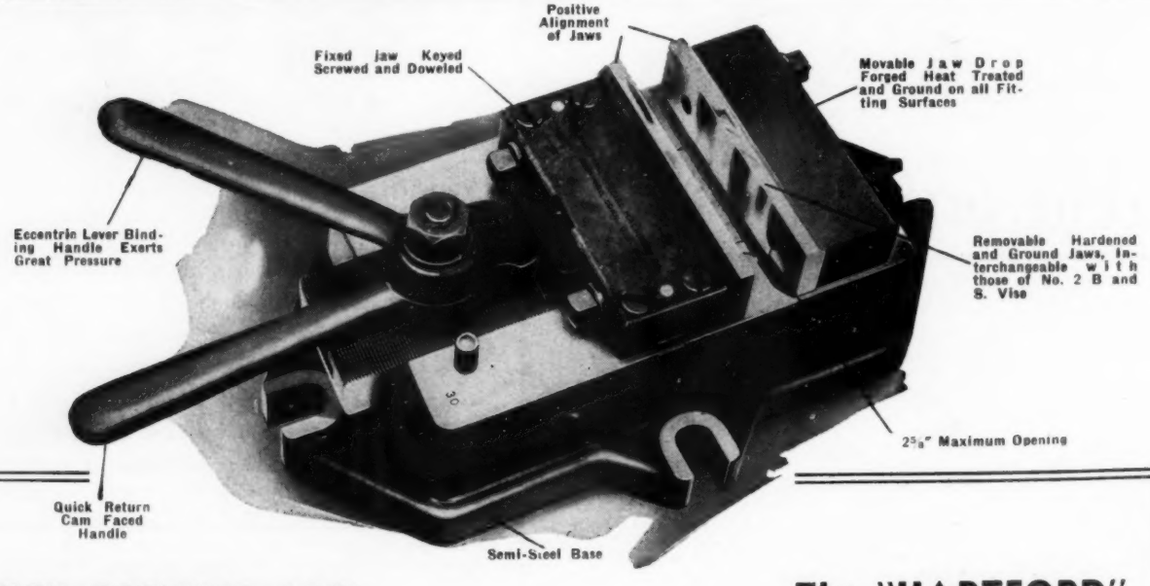
Because of its precision, great versatility and quick set-up, the Nichols Hand Miller is particularly adapted to tool room requirements. Its wide use in this class of service by leading manufacturers is evidence of its recognized value and suitability in meeting the requirements of modern shops.

•

Capacity: Longitudinal Feed, 10"; Transverse Feed, 7"; Vertical Feed of Knee, 13½"; Vertical Movement of Head, 4½", Working Surface of Table, 6½" x 21"; Spindle Speeds, 100, 200, 600 and 1200 R.P.M.

Send for Illustrated Bulletin giving Complete Information

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*


Positive Alignment of Jaws
Fixed Jaw Keyed Screwed and Doweled
Movable Jaw Drop Forged Heat Treated and Ground on all Fitting Surfaces
Eccentric Lever Binding Handle Exerts Great Pressure
Removable Hardened and Ground Jaws, Interchangeable with those of No. 2 B and S. Vise
2⅝" Maximum Opening
Quick Return Cam Faced Handle
Semi-Steel Base

QUICK OPENING AND TREMENDOUS BINDING POWER *assured by* The "HARTFORD" MILLING VISE

The "Hartford" can be depended on for fast work, accuracy and power. It is ideal for use in small arms production because it can be depended on to speed production milling and hold work securely and accurately under any demands. All operations are controlled by two levers which may be easily manipulated with one hand. Highest accuracy is assured by positive jaw alignment. Jaws are drop forged, heat treated and ground on all fitting surfaces.

SPECIFICATIONS

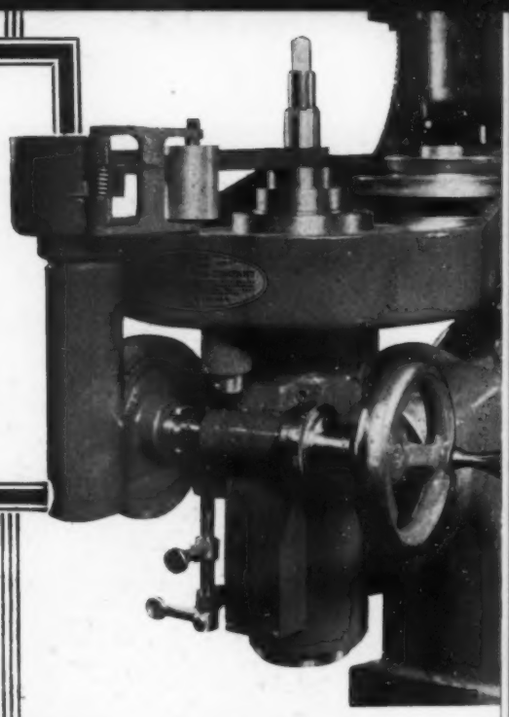
Made in plain and swivel jaw types
Width of jaw 5"
Depth of jaw—1 3/16"
Max opening (Plain)—2⅝"
Max. opening (Swivel)—2¼"
Overall Dimensions: 13"x8"x5"
Weight 40 lbs.

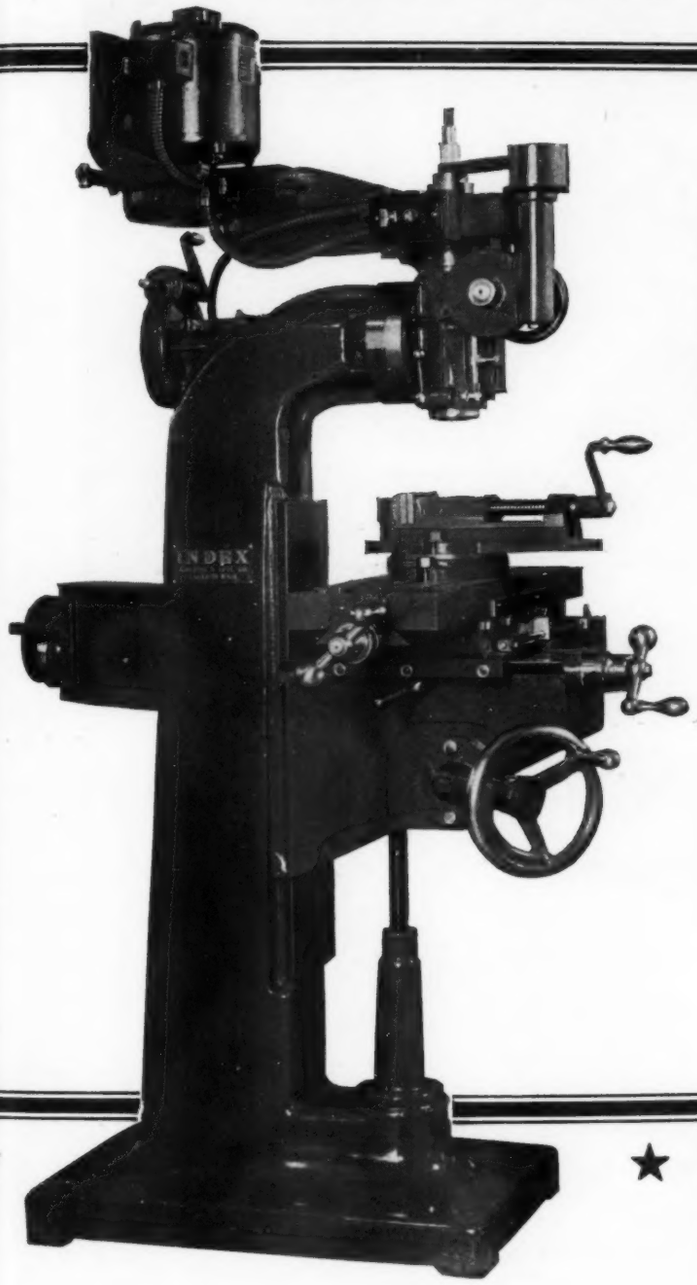
WRITE for COMPLETE INFORMATION

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD, CONN.

NEW →

Power Feed to the Spindle
on
INDEX MILL





● This addition to the Index Mill is the result of many requests from production men who use the machine for jig boring. For complete details send for our new illustrated folder.

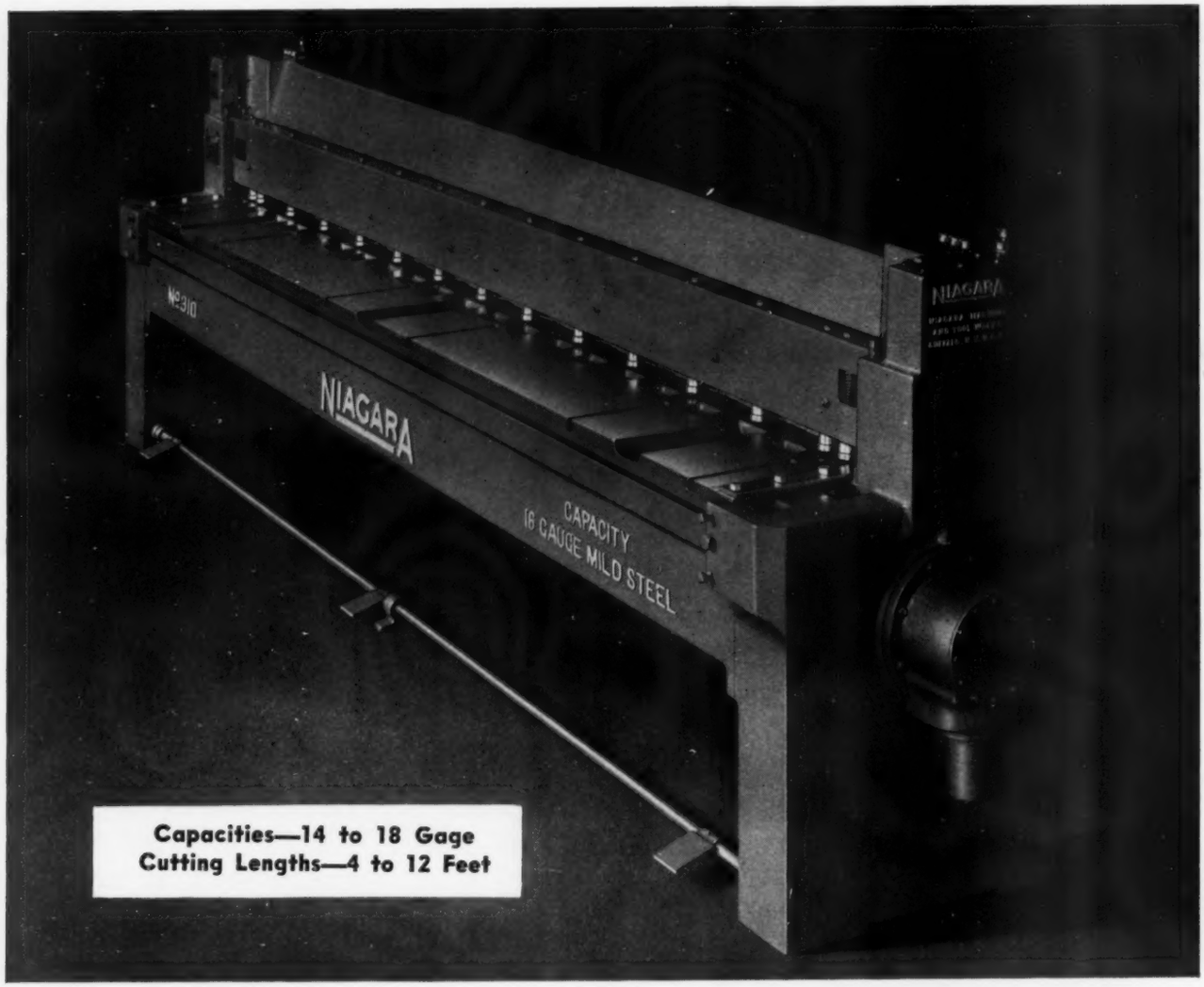
Are being used very successfully doing precision work on small parts for guns, instruments, aeroplanes, etc. in addition to the great performance in tool, die and experimental rooms where they were originally introduced.

Three to five Index Mills can be bought for the price of one conventional type machine.

Three to five Index Mills can be made in the time it takes to make an ordinary mill. The Index handles the lighter jobs just as fast and in many instances faster. The final answer is three to five times as many munition parts from the same amount of dollars and time invested.

WRITE for descriptive folder

BLANK & BUXTON
MACHINERY CO.
3106 E. MICHIGAN AVE., JACKSON, MICH.



NIAGARA SERIES NO. 3 POWER SQUARING SHEARS

Speed Up Wartime Output

This series of Niagara Power Squaring Shears offers many new and exclusive improvements resulting in new standards of cutting accuracy, high production, and freedom from costly down time.

They operate at a speed of 80 strokes per minute. Instant acting Niagara sleeve clutch, ball bearing self-measuring back gage, full visibility of the cutting line, and convenient handling of sheets speed up squaring and trimming.

The sloping back of the bed acts as a chute for directing off-cut material to rear.

Drive mechanism including flywheel, gearing, clutch, eccentrics and connections is enclosed and operates in oil, thus assuring long life, low maintenance cost and utmost safety. Motor is direct connected.

A new detent device requiring no attention or adjustment replaces the customary friction brake.

Standard equipment includes front, side and back gages, and four-edge, solid tool steel knives.

NIAGARA MACHINE & TOOL WORKS, BUFFALO, N. Y.

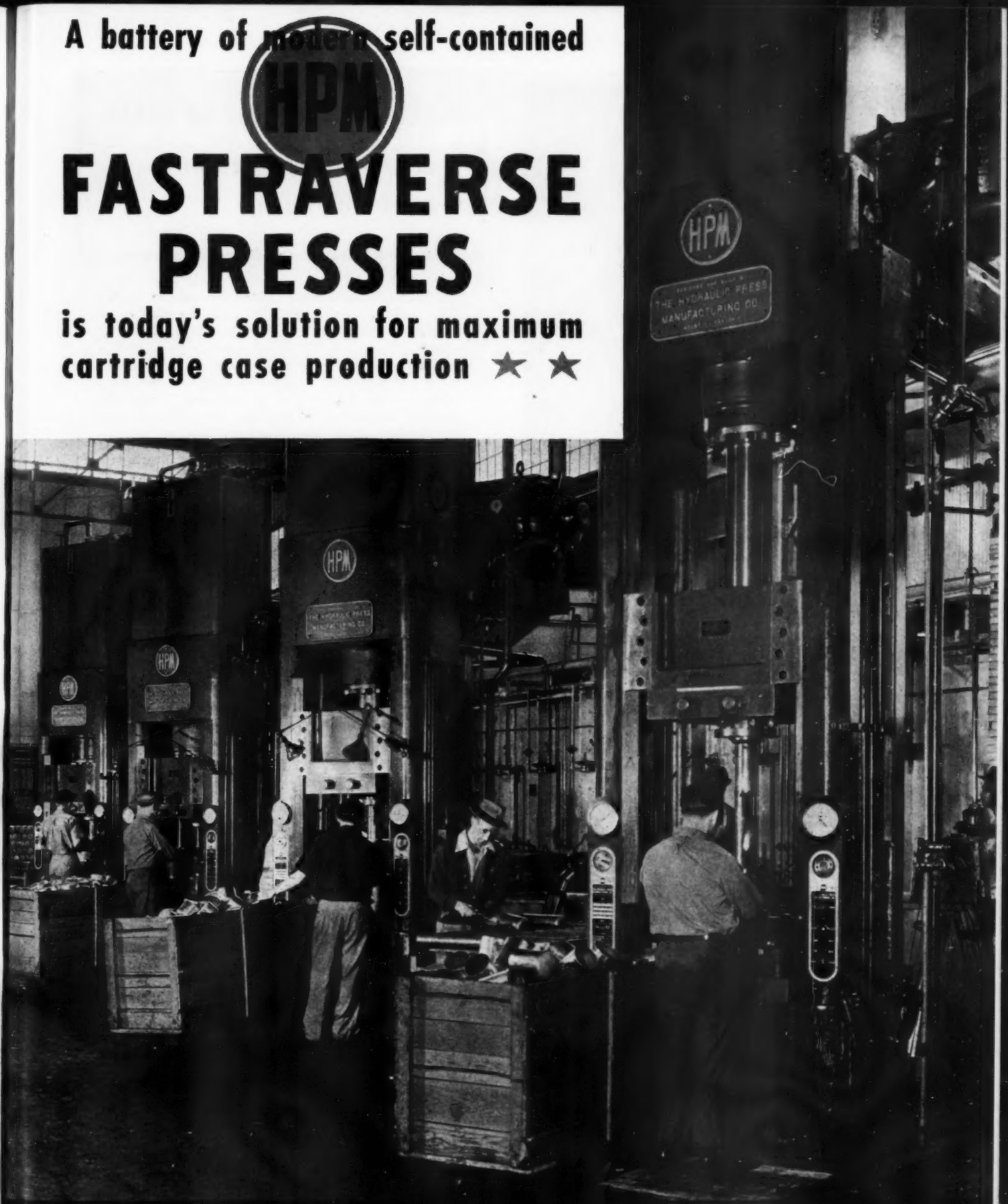
50 Church St., New York — Leader Bldg., Cleveland — General Motors Bldg., Detroit

A battery of modern self-contained

HPM

FASTRAVERSE PRESSES

is today's solution for maximum cartridge case production ★ ★

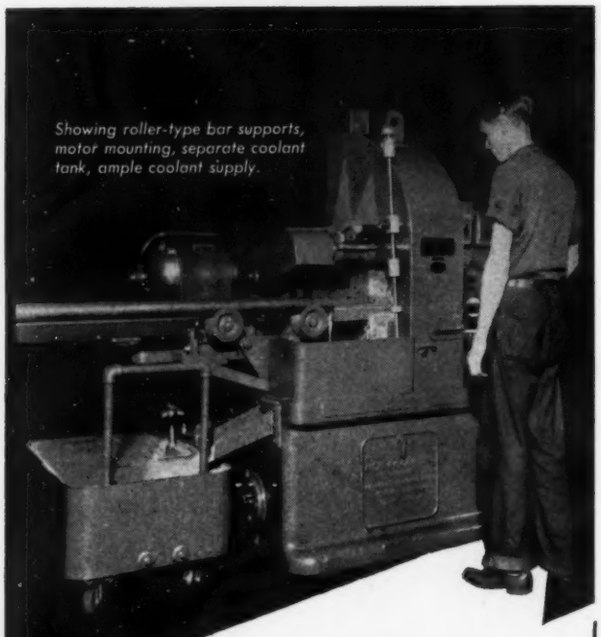


Each HPM press is equipped with the H-P-M "valveless" Closed Circuit operating system including an H-P-M Radial piston type pump for generating pressure. Presses close and open at a speed of 1200"/Min. and actually draw metal at 400"/Min. Illustrated above are the cupping and first three drawing presses of an "all hydraulic" H-P-M cartridge case press line.

THE HYDRAULIC PRESS MANUFACTURING CO.

Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities.



Showing roller-type bar supports, motor mounting, separate coolant tank, ample coolant supply.

THERE IS A CAMPBELL ABRASIVE CUTTING MACHINE THAT WILL GIVE YOU THE BEST PRODUCTION PER MAN HOUR AND PER SQUARE FOOT OF FLOOR SPACE

See if your cutting doesn't fit into this wide range of work—jobs being cut right now by **CAMPBELL ABRASIVE CUTTING MACHINES:**

1 • From soft anneals to alloy steels

2 • Annealed and unannealed material

3 • Tubing, odd shapes, solid rounds up to 6" in diameter; flat stock up to 4" thick

4 • Plastics, glass, ceramic materials, etc.

And check this list of important war production jobs on which they use **CAMPBELL ABRASIVE CUTTING MACHINES.**

- Aircraft engine crank shafts
- Aircraft engines
- Aircraft assembly parts
- Army cars, trucks, tanks
- Machine guns, bombs, shell casings
- Small arms ammunition
- Projectiles
- Field telephones

The chief value of cutting with a **CAMPBELL ABRASIVE CUTTING MACHINE** is that the work is not burned; cuts are so clean that they save the cost and time of finishing; cuts are obtained at *production* speed and wheels last longer.

Ask to have a Campbell engineer show you exactly what a Campbell machine can do for you.

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT · CONNECTICUT

Campbell ABRASIVE CUTTING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

Mathematics made plain

—and easy-to-learn
—and amusing!

THAT is the purpose, completely realized, of this new mathematics text. The authors begin (with a humorous story) right on the edge of the Unknown where arithmetic can no longer show the way. After a thorough course in algebra they take you on a survey of the highlights of trigonometry, analytic geometry, more advanced algebra, and calculus, with a seasoning touch of the theory of numbers. The style is light, the explanations are detailed and the book makes highly interesting reading.

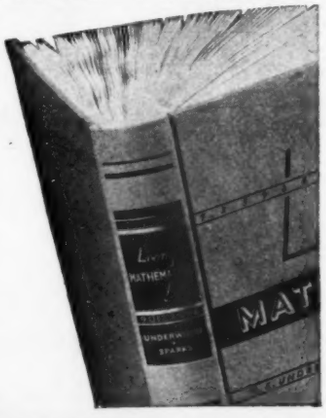
LIVING MATHEMATICS

By R. S. Underwood and Fred W. Sparks
Texas Technological College
365 pages, 6 x 9, $3.00

HERE is just the book for: Those who have met with initial failure in trying to master the intricacies of the subject; and now, as adults, can be expected to make real headway when the subject is presented as a fascinating pastime.

Those who 'took to it' readily when first presented; and now wish to pick up the threads and go on to higher mathematics, — the calculus and number theory.

In this book you will find drama, zest, humor, surprise, challenge and human interest.



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Send me for 10 days' examination, subject to approval or return, Underwood and Sparks—Living Mathematics. At the end of 10 days I agree to pay $3.00, plus a few cents for postage and delivery, or return the book postpaid. (We pay postage on orders accompanied by remittance.)

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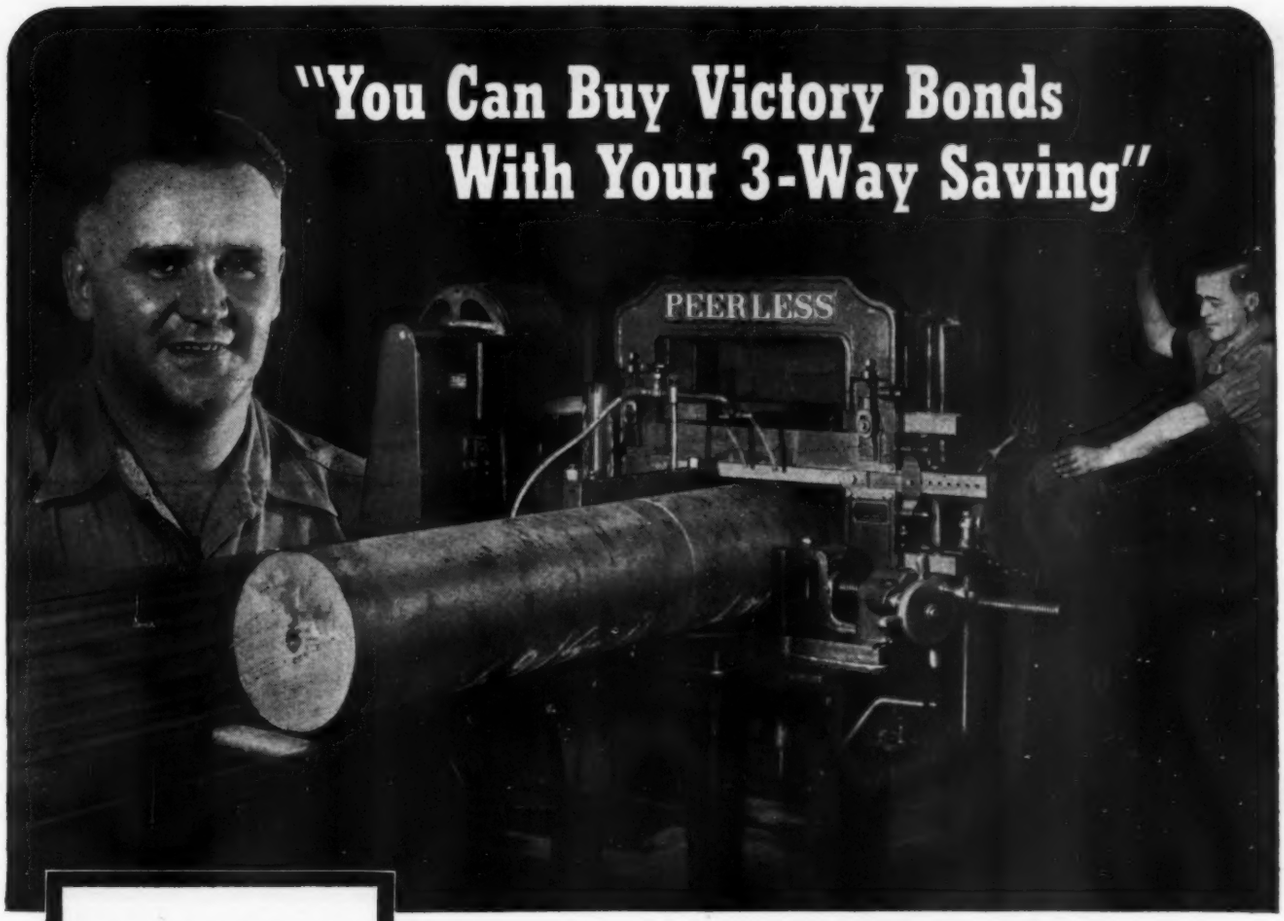

PERFORMANCE REPORT "N"

Sawing 12¾" diesel crosshead shafts to minute accuracy. 2000 Sq. In. are cut on a single blade. The shafts are used in 3600 H.P., Diesel Engines for the Navy.

Peerless Saws Save TIME • METAL • BLADES

This three-way saving, on hundreds of hurry-up government contracts, is helping employer and employee save more for Bonds and Stamps. Blade savings count up fast when the metal is SAWED with a High Duty Peerless. A cushioned, hydraulic control to the Four-Sided Saw-Frame smoothly applies just the right feed and speed at the right time.

Fast cutting is practical. Accurate cutting is sure.

Saving time and metal is a cinch when the first and final cut is made on a Peerless.

Less metal removed by the thin, cool-cutting blade means — Less Blade Wear . . . Less Cutting Time . . . Less Haul-Back Tonnage . . . and Less Re-Roll Expense for the Steel Mill.

You, too, can save more by SAWING with a Peerless. Send Samples of your toughest materials. We'll cut them and tell you how.

PEERLESS MACHINE COMPANY • RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-442, Racine, Wisconsin

Mail cutting time estimate for.....

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☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City..... State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

TAKE THE BOTTLENECKS OUT OF YOUR COLD METAL SAWING OPERATIONS

Cut your 3 inch and larger stock on the PORTER-McLEOD *and save time*

This new machine provides an economical means of handling your cutting off operations on a high production basis. More cuts, greater accuracy and lower operating and maintenance costs are outstanding advantages offered you by the 8" Porter-McLeod Cold Metal Sawing Machine.

This machine is recommended for general work and for production work in single or multiple units. Its capacity permits of "nesting" bars and shapes using the Porter-McLeod systems of "multiple or interchangeable nests" which provide support for each nest on both sides and bottom. By this method of nesting of bars and shapes, multiple units can be cut at one time and work speeded up.

Ability to cut stock from 3 inches and up at high speed and with straight cuts is made possible by the Porter-McLeod method of pulling the blade upward through the stock and by supporting the blade, front and back on diameters well out from the center where support is needed.

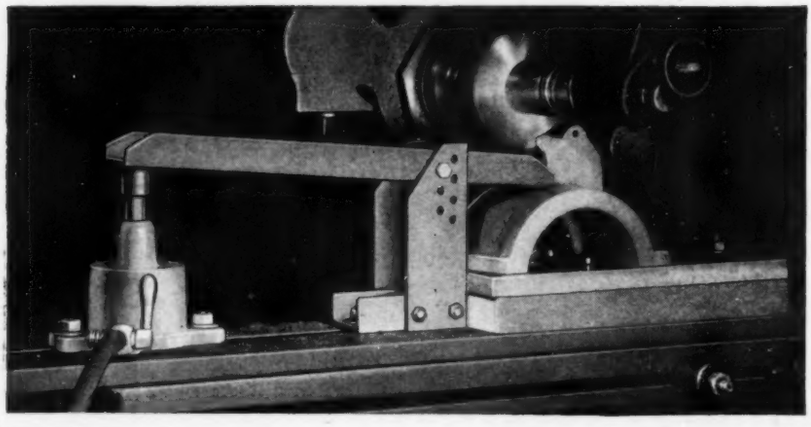
These and other outstanding valuable features are fully described in engineering bulletin available on request. Send for your copy TODAY!

PORTER-McLEOD MACHINE TOOL CO., INC.

HATFIELD, MASS., U.S.A.

MACHINE TOOL COMPANY

MEAD'S NEW V4 AIR CLAMP



INCREASED OUTPUT 5 TIMES!

See how "V4"—newest member of the Mead Air Clamp family—brought new productive life to an ancient manufacturing miller. Photograph at left shows how walking beam hold-down was rigged to instantaneously provide 600 pounds pressure to the work—eliminating nuts, wrenches and dogs. *The output on this job was increased nearly 5 times!* Let Air Clamps speed *your* milling and drilling operations. Write now for complete details and assistance on *your* work-holding problems.

FOOT AIR CONTROL READY!

For air-operated devices. Frees hands, speeds work. 2 models. Write for details.

MEAD 4X AIR CLAMP

WHEREVER a drill comes down, *something* must hold the work. Wherever a drilling-jig is required, *Air-Clamp* will simplify it. Wherever *speed* is desired, *Air-Clamp* will produce it. *Air-Clamp* holds with relentless pressure; it is undisturbed by size variations (such as in castings), it scoffs at vibration (how many drills have been broken due to faulty hold-downs?), chatter, snagging. *Air-Clamp* holds work of any size or shape in any position, at any angle. It can pay for itself on a single fixture; it can save its cost on a few days' drill-press output. It reduces operator fatigue. It saves hours and dollars in drafting-room, jig department, tool room and production line. *Air-Clamp* fits any drill-press having a cylindrical column. Special fixtures for Tee-slotted tables, light milling work, etc. Hand and/or foot control. Shipped on approval to responsible concerns.

MEAD SPECIALTIES CO.

15 So. Market St., Dept. 4-MA CHICAGO

Increased Production

means more jobs for

MACHINISTS

—and MORE PAY for men who know their work

This home-study course gives you the practical facts on modern machines, up-to-date methods, you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

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6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations —show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

Puts the mastery of machine-shop work at your fingertips

With these books at hand for quick reference, no job is too hard or unusual, and the routine jobs may be improved, with savings in time and trouble and reduced wastage.

What the Library gives you

—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice

—description of all important varieties of machines, both manual and automatic, and methods of operating them

—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.

—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work.

—training in the various operations performed in drilling and surfacing materials in the machine shop

—exact, descriptive data on all aspects of gear-cutting practice, useful in shops of any size

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Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' Examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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Address .....

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Position .....

Company .....A. 4-30-42

Don't

OVERLOAD YOUR HOIST

○ Although **WRIGHT HOIST** are built with load-carrying factors much in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Abuse to machinery, today, is akin to sabotage.

WATCH THE BOTTOM HOOK

● Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, gives visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

WATCH THE LOAD CHAIN

● **WRIGHT HOIST** load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Chains that are excessively overloaded will stretch out of pitch, thus preventing proper fit with precision load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well-lubricated for long life.

Victory demands all out efficiency in production. Victory demands speed. Victory demands steel. Abuse of machinery wastes all three. Take proper care of your **WRIGHT HOIST** so that it lasts. You can find the name of your nearest Wright distributor in the telephone book.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, San Francisco, New York

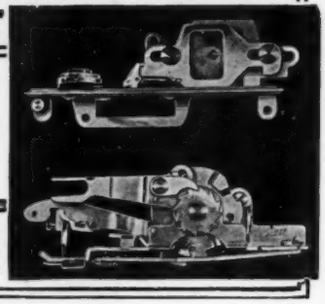
In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

CONTRACT WORK

STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"



We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

THE GREIST MFG. CO.
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Need steel balls

for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS

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MACHINE COMPANY
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WE SOLVE TOOLING PROBLEMS
Designers of
TOOLS • DIES • JIGS
FIXTURES • GAGES

Our staff is experienced in tooling up, processing and designing for war production. We can handle your problem. Your inquiry entails no obligation.

ALGER ENGINEERING CO.
2539 Woodward Ave. Detroit, Mich.

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
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PAWTUCKET, R. I.

DESIGNERS OF
• TOOLS, JIGS, FIXTURES
• SPECIAL MACHINERY
ORDNANCE WORK A SPECIALTY
OLD COLONY ENGINEERING CO.
180 WEEDEN ST. PAWTUCKET, R. I.

FORGINGS

• All types up to 6,000 lbs. Smooth Forged—Finished—Rough Turned, Hollow Bored and Heat Treated to Specifications. Crank Shafts—Shafting—Connecting Rods

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ERIE PENNSYLVANIA

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

"More Subcontracting Will Help Win the War."

—Donald M. Nelson

In an open letter to the major prime contractors handling war contracts, the War Production Board Chairman made this statement. He went on to say, "Every available idle tool that can be put to work must be put to work. This may cost more, but the job must be done fast, and experience has taught us that some prime contracts can be subcontracted as much as 90%."

Backed by the authority of Mr. Nelson, this statement bears weight. Many companies are striving to expand their production by subcontracting but, in many cases, find it difficult to locate the capacity they want. You can capitalize on this by advertising your facilities in AMERICAN MACHINIST'S Contract Work Section. Production men have come to refer to this Section when they need outside help and your message, outlining your facilities, will help them. It gives you a chance to tell your story to the prime contractors as no other method can and stamps you as an alert, active company.

We would like to show you how reasonably you can reach these men and get your share of our war production job through advertising here. A postcard or letter will bring you the complete details. We think you will be pleasantly surprised at its low cost. No obligation, of course. In any case we would like to have a list of your available facilities to turn over to companies needing capacity of your type.

CONTRACT WORK DEPARTMENT

AMERICAN MACHINIST
330 West 42d St. New York City

CONTRACT WORK

FOR YOUR IMMEDIATE USE

5,000 MAN HRS. PER WEEK OF TOOL, DIE AND SPECIAL MACHINE DESIGNING

Est. 1930

PRODUCT ENGINEERING SERVICE

Tel. OL 3300 3301

2485 BEAUFAIT AVE. DETROIT, MICHIGAN

CONTRACT WORK—

We can build machines and parts, special tools and fixtures of all kinds to your specifications and design. Skilled workmen and modern equipment are your guarantee of satisfaction. The design and building of wire and ribbon stock forming machines are our specialty.

We solicit your blueprints or samples for quotation. No obligation of course.

THE A. H. NILSON MACHINE COMPANY

Bridgeport, Conn.

High Production Sheet Metal Plant for War Contract Work

Modern one-floor plan factory of 65,000 sq. ft. strategically located at Dayton, Ohio, experienced in wide range of sheet metal work employing 14 to 30 gauge sheet steel or other sheet metal. Staffed with skilled workers. Especially equipped for square shearing and forming sheet steel with shearing capacity of four tons in eight hours; blanking and punching up to 56-ton capacity, punch press bed sizes 21" to 32"; spot and arc welding; chucking operations with P&J lathes; painting and enamel baking; complete assembling including supplementary operations, riveting, dynamic balancing equipment, etc.

Our years of experience and skilled workmen assure you a quality job at a reasonable price. Send us blue prints and complete data on your work for specific quotations. Or ask for one of our representatives to call with complete inventory of our equipment, capacities, etc. He'll be glad to obtain the information for you. Write, wire, or phone Dayton, ADams 7239.

The Lau Blower Co.

Dept. 100A—2001-2029 Home Ave.

DAYTON, OHIO

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER

STEEL PRODUCTS CO.

1103 E. 23rd St. INDIANAPOLIS, IND.

KIRK & BLUM

WELDED MACHINE BASES, PEDESTALS and FRAMES

LATHE PANS

GEAR and BELT GUARDS

Pressed Steel Louver Panels and Cover Plates

THE KIRK & BLUM MFG. CO.

2823 Spring Grove Ave., Cincinnati, Ohio

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.

C. VANDERGRIFT CO., INC.

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SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.

Thirty Irving Place New York City

36 years experience in metal fabrication.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.

JUNCTION AVE. DANVILLE, ILL.

We Want War Work

72 yrs. in the business

Large, medium and small

WOOD PATTERNS

NASHUA PATTERN & MODEL CO.

NASHUA, N. H.

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small

MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS

2233 Buck Street Cincinnati, Ohio

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., May 5th will appear in the issue of May 14th, subject to limitations of space available.

WANTED

HYDRAULIC ENGINEER

Wanted immediately a capable and experienced hydraulic expert for machine tool applications. Refer:

P-230, American Machinist
330 W. 42d St., New York City

WANTED

MACHINE TOOL DESIGNER

One of the finest equipped plants in the Metropolitan District requires a machine tool designer of the highest type; one who has proven ability in creative work and initiative. This is a rare opportunity for the right man. No letter considered that does not give complete details of background.

P-240, American Machinist
330 W. 42nd St., New York, N. Y.

AUDELS
MACHINISTS
AND TOOL MAKERS HANDY BOOK

JUST OUT!

A READY REFERENCE
Tells How to Operate and Set Up Lathes, Screw and Milling Machines, Shapers, Drill Presses and All Other Machine Tools.

A KEY TO SHOP PRACTICE
In All Branches. For Every Machinist, Toolmaker, Machine Operator, Draughtsman, Metal Worker, Mechanic and Student.

5 PRACTICAL BOOKS IN ONE! 60 FULLY ILLUSTRATED CHAPTERS
Covering 1—Modern Machine Shop Practice. 2—Blue Print Reading and How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use the Slide Rule.

1600 PAGES FULLY ILLUSTRATED
ASK TO SEE IT

$4 Get this information for yourself. Mail coupon today. No obligation unless satisfied.
COMPLETE • PAY ONLY $1 A MO.

AUDEL, PUBLISHERS; 49 W. 23rd ST., NEW YORK
Mail AUDELS MACHINISTS & TOOLMAKERS HANDY BOOK, Price $4 on 7 Days Free Trial. If O. K. I will remit $1 in 7 days and $1 monthly until $4 is paid. Otherwise I will return it.

Name_____
Address_____
Occupation_____
Reference_____ A.M.M.

POSITIONS VACANT

EXPERIENCED, CAPABLE ENGINEER and Designer wanted, one familiar with horizontal boring machine design. Give resume of education, experience, etc. Write P-226, American Machinist, 330 W. 42nd St., New York, N. Y.

DIE MAKER that will qualify for Die sinker of steel dies for drop hammer tool specifications offering unusual opening for correct man with ability to eventually acquire supervisor die department of established tool manufacturer located in small town, replacing elderly about ready to retire, opportunity to secure steady position with good future. Address P-241, American Machinist, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

WORKS MANAGERS, Factory Superintendents, General Foremen, Production Managers, Purchasing Agents, Chemists, Mechanical and Electrical Engineers, Personnel Managers wanted immediately. Salaries $3000 to $15,000 per year. Also Designers and Draftsmen of all kinds. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson Blvd., Chicago.

For Sale or on Royalty Basis.
U. S. Patent No. 2,267,647
AN IMPORTANT IMPROVEMENT for INDEX HEAD for MACHINE TOOLS
For information write
FRANK S. APPLEMAN, Patent Attorney
1331 G. Street, N.W. Washington, D. C.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

PROFESSIONAL SERVICE

Machine Tool Designing Engineers

30 Years Experience in Designing Building & Developing Production Machinery & Processing Operations

Automotive — Tractor
Airplane — Munitions

W. K. Millholland Machinery Co.
1115 E. 35 St., Indianapolis, Indiana

POSITIONS WANTED

AUTOMATIC SCREW MACHINE Foreman. Experience, 17 years—age 40. PW-196, American Machinist, 330 W. 42nd St., New York, N. Y.

WORKS MANAGER or General Superintendent thoroughly experienced with shop processes, practices and systems. Good coordinator, organizer and maintainer of labor relationships while getting results. Experience in training programs, sub-contracting, estimating with standard data. Thorough mechanic. PW-234, American Machinist, 330 W. 42nd St., New York, N. Y.

POSITION WANTED — with Hydraulic company. College trained, mechanical engineer, with six years experience in this field. Capable of designing, layout, and stress analysis. Familiar with all pumps, valves, oil circuits and press design used today. American Citizen. PW-242, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

EXECUTIVE—wishes to transfer effort from advertising and selling to essential work in defense. Dozen years of varied executive experience. Willing to accept sacrifice in salary but hopeful of receiving responsibility on par with that previously enjoyed. Reply PW-243, American Machinist, 330 W. 42nd St., New York, N. Y.

PRODUCTION PROMOTION MANAGER wishes position involving duties of Personnel and Industrial Relations executive, combined with modern slant on production promotion. PW-244, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or Superintendent with 30 years experience in the development and the production of tools, machinery, electrical, optical, and mechanical devices. Interested in connections paying $10,000 per year. PW-245, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

MANUFACTURERS REPRESENTATIVES

Successful agency with keen, experienced staff of engineer-salesmen, established headquarters, 25 year acquaintance with Michigan industry seeks additional lines in construction field or in special tools, equipment or merchandise for war industries. Reply
RA-239, American Machinist
520 No. Michigan Ave., Chicago, Ill.

NOTICE

The following notice will be published with Positions Vacant advertisements in future issues:

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

Positions Vacant advertisers are asked to indicate their acceptance of this agreement in forwarding copy.

Equipment Wanted—Page 124

MACHINE TOOLS
To Help You
SPEED PRODUCTION

AUTOMATICS
3¼" Single Spindle Gridley
No. 73 Prentice Chucking 8 Stations

BORING MILLS
48" Putnam Car Wheel
52" Betts Car Wheel
Slotting Attachment for Vert. Mill

DRILLS
10" Signourney Sensitive
12" Elliott Sensitive
One Spindle Allen H.S., B.B.
One Spindle Avey H.S., B.B.
One Spindle Henry Wright Class B
28" Barnes Sliding Head
30" Snyder Sliding Head
36" Snyder Sliding Head
No. 23 Foote-Burt M.D.
Two Spindle Rockford Sensitive
Two Spindle Prentice Sensitive
Three Spindle Rockford 23"
Four Spindle Rockford 23"
Four Spindle Foote-Burt No. 5 Taper
Four Spindle Bickford No. 4 Taper
No. 39 Natco Straight Line
No. 3 Baush Rectangular Head
No. 12 Pratt & Whitney Rectangular Head

RADIALS
30" Henry Wright Sensitive
36"Carlton Sensitive
5' Prentice Plain, Cone
5' Niles Plain
6' Niles Plain

GRINDERS
10"Pedestal, belt drive
8" Excelsior Pedestal
12" Bridgeport D.C. Motor
Webster Perk, polishing stand
⅛" to 2¼" Drill Grinder
8"x36" B&S Cylindrical
Beyer Peacock Vertical Internal
14" P&W Surface
12" Besley Disc. S.P.D.
10" Besley Disc. S.P.D.
22" Besley, Universal table
24" Gardner Disc
16" Gardner Ring Wheel
18" Two Spindle Sizing
18" Besley Double Spindle

GEAR CUTTERS
24"x8" B&S Spur
24"x9" G&E
36"x10" B&S Spur
60"x12" B&S Spur
64"x20" G&E Spur
50"x8" G&E Spur & Bevel
60"x16" G&E Spur & Bevel
90" P&W Spur & Worm
6" Bilgrim Bevel Generator
16" Bilgrim Bevel Generator
15" Gleason Bevel Generator

LATHES
18"x15' N.B.P. Carboloy
18/44 Putnam Ext. Bed
24"x10' L&S Patent G.H.
30"x15' L&S Cone Drive
32"x21' Niles Forge, turning
48" Tindell-Morris Crankshaft, M.D.

MILLERS
No. 2 Sloan & Chase, Bench
P&W Duplex, table 10"x39", light
No. 1 Knight Mill & Drill
No. 9 Niles Vertical
No. 10 Niles Vertical
30"x30"x10' Newton Slab
42"x30"x15' Newton Slab
4" P&W Spline
Newton Axle Keyseating

PLANERS
36"x36"x8' Gray, 2 heads
36"x36"x12' Pond M.D.
42" Newton Rotary
72"x72"x12' Sellers, M.D.

PRESSES, PUNCHES & SHEARS
No. 3 Simmons O.B.I.
No. 16 Bliss O.B.I. Trimming
3A Greenard Arbor
400-Ton Niles Double Wheel
10-Ton Henry Wright Dieing
20" Throat H&J No. 00
42" Throat H&J No. 4
42" Throat H&J No. 2
54" Throat H&J No. 5
60" Throat L&A No. 250
20" Throat Cleveland Double End
24" Throat L&A Double End
24" Throat Cleveland Double End
36" Throat Southwark Double End
Schultze Norman Beam Shear
No. 6 Buffalo Diagonal Bar

SAWS
7" cap. Cochrane Bly No. 5
7" cap. Newton Cold Saw
9" cap. Newton No. 204
12" cap. Newton No. 574
Campbell Abrasive No. 302
Radiac Abrasive, 3 motors
No. 2 Garbo Saw Table
Nutter Barnes Sharpener
Espen Lucas Sharpener

SLOTTERS
12" New Haven
12" Sellers, M.D.
14" Putnam
16" Sellers, M.D.
30" Baker, Draw Stroke
60" Newton Portable

TURRET LATHES
18" Warner Swasey
18"x6' Springfield Fox Monitor
No. 2 Woods Tilted Turret
Lasffer Millholand Staybolt

MISCELLANEOUS
10"x10" Curtis Air Compresser
12"x8' Ingersoll Rand
No. 3 La Point Broach
1½" Acme Bolt Threader
No. 3 Manville Bolt Trimmer
8' Pexto Cornice Brake
18'x18 ga. Hydraulic Press Brake
No. 2 Stoever Pipe Bender
No. 5 Roots Foundry Blower
3" Pawtucket Cut-Off
5" P&W Centering
8' H&J Flanging Clamp
Stewart Combination Furnace
1½" Ajax Header
2" Acme Header
200# Bradley Compact Hammer
300# Bradley Hleve Hammer
No. 3 Catlin Keyseater
No. 5 Mitts Merrill Keyseater
West Hydraulic Tire Setter
40,000 gallon Water Tower
No. 1 Campbell Nibbler
2" Landis Pipe Threader
6" Bignall Keller Pipe Threader
6" Landis Pipe Threader
10" Standard Pipe Threader
14" E.C. & B Pipe Threader
3¼"x12" Triplex Pump
236 GPM, 60' Centrifugal
1000 GPM 100# Centrifugal
1000 GPM Steam Fire Pump
30-Ton Hanna Rivetter
¼"x6' Pyramid Rolls
1" Six Spindle Nut Tapper
2" Six Spindle Nut Tapper
No. 8 Gaterman Vert. Tapper
4" Baker Vert. Tapper or Reamer
16" Baker Vert. Tapper or Reamer

WOODWORKING
No. 1 American Saw Bench
American Variety Woodworker
15" Swing Saw
18" Rogers Jointer
Fay Egan Lightening Sander

R. R. SHOP TOOLS
52" Putnam Car Wheel Borer
52" Betts Car Wheel Borer
Set of Locomotive Cylinder Chucks
Newton Axle Keyseat Miller
No. 2 Niles Double Axle Lathe
No. 4 Putnam Double Axle Lathe
No. 3 Niles, center drive
Bridgeford Journal Truing
42" Putnam Car Wheel Lathe
42" Niles Car Wheel Lathe
48" Niles Car Wheel Lathe
85" Putnam Driving Wheel Lathe

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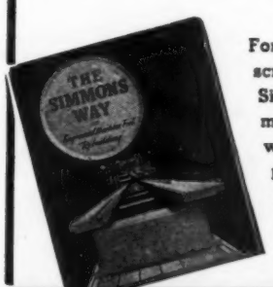


For a complete description of how Simmons rebuilds machine tools, write for this 58-page illustrated book, "The Simmons Way."

Write for a rebuilding estimate on YOUR tools.

SIMMONS ENGINEERED *Machine Tool* REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
New York Office: 149 Broadway

...IN STOCK

AUTOMATICS
No. 55 National Acme, four spindle
No. 53 National Acme, four spindle

BROACHES
No. 3 LaPointe
Hercules 15 ton vertical

DRILLS
5' Western Radial
No. 25 Foote-Burt
3 Spindle Henry & Wright
4 Spindle Rockford
No. 12 Natco Multiple Spindle

GEAR CUTTERS
96" Gleason Gear Planer
18"Gleason Straight Bevel Generator
15" Gleason Spiral Bevel Generator
16" Gleason Gear Tester
No. 2 Pfauter Gear Hobber
5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder

GRINDERS
No. 55 Heald Internal
No. 60 Heald Internal
12"x42 Landis Cylindrical
No. 2 Diamond Surface
16"x50" Norton Crankshaft

LATHES
13"x6' Willard, c.d. s.x.c.
14"x6' Monarch, c.d.
16"x6' Lodge & Shipley, c.d.
18"x6' Lodge & Shipley, c.d.
18"x8' Monarch, c.d.
21"x8' LeBlond, c.d.
18"x24' Axelson, c.d.
3½"x60" Fitchburg Lo Swing, g.h.

TURRET LATHES
No. 3A Warner & Swasey
No. 2A Warner & Swasey
No. 4 Warner & Swasey Universal, g.h.
No. 1 Warner & Swasey
No. 3 Foster, g.h.

MILLS
1½B Milwaukee, s.p.d.
No. 2M Cincinnati, rect. o.a. motor in base
No. 2 Rockford, c.d.
No. 7 Becker, Lincoln Type
No. 4 Hendey, Lincoln Type

MILLS, VERTICAL
No. 2M Cincinnati, motor in base
No. B Becker

MISCELLANEOUS
10" Putnam Slotter
⅜"x18' Nilson Wire Straightener
Wicaco Oil Groover
Pratt & Whitney Spline Mill

PLANERS
26"x26"x8' Gray
30"x30"x8' Cincinnati
42"x42"x12' Whitcomb

TAPPERS
No. 2X Garvin
½" Rickert Shafer, Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

EASTERN OFFERS

MILLING MACHINES
No. 2 Knight
No. 25 Bilton Plain
C17 Newton Vertical Slab
No. 2 Garvin Lincoln Type
6x14" Pratt & Whitney Thread
24" Cincinnati Automatic Duplex
36"x36"x14' Bement Slab, m.d.
40" Ohio Tilted Rotary, m.d.
C66A Newton 3 spindle Continuous, s.p.d.

GEAR CUTTERS & HOBBERS
6", 18" Gleason Straight Bevel
Gleason Spiral Bevel Rugher
16" Gould & Eberhardt Gear Cutter
No. 1-26" Whiton Full Universal Spur & Bevel
No. 3-26" Cincinnati Spur
No. 3-26", 3-36", 3 Heavy, 4-36", 4-48", 6-60", 6-72" Brown & Sharpe Spur
Cross Gear Tooth Rounder

TURRET LATHES AND SCREW MACHINES
No. 1B Foster Universal, m.d., chucking
No. 0 Brown & Sharpe Hand Screw Machine
2¼x24" Jones & Lamson Geared Head, bar
3x36" Jones & Lamson Geared Head, chucking
3x36" Jones & Lamson 2 spindle Geared Head, chucking
3x36" Jones & Lamson Geared Head, bar
3¼x40" Greenlee Flat Turret, bar
24" Gisholt Model I, m.d., chucking

SHAPERS
16" Hendey Friction Type
32" Morton Railroad Type Draw, Cut, m.d.

PLANERS
24"x24"x5' G. A. Gray, 1 head
24"x24"x12' Chandler, 2 heads
30"x30"x8' Cincinnati, 1 head

SLOTTERS
84" Newton Vertical No. G16, m.d.

ENGINE LATHES
13", 15" by 6' Willard, cone
15"x8' South Bend, cone
16"x8' Greaves-Klusman, cone
16"x8' Sebastion Geared Head, m.d. in base
18"x8' Bradford, cone
18" raised to 28"x10' Reed, cone
18"x12' Barker, cone
20"x10' Pond, cone
21"x12' Bradford, cone
22"x13' Niles, cone
18"x6' Bradford, cone
22"x13' Niles, cone

22"x16' centers American 100 H.P. Input Super Lathe, with 100 H.P. D.C. variable speed motor and 4 additional D.C. motors, has power rapid traverse, chip conveyor, steel steady rest, total weight 65,000 lbs.

22"x18' Niles, cone
24"x8'6" Bridgeford, m.d.
24"x10' Bridgeford, cone
24"x10' Whitcomb-Blaisdell, cone
24"x11' Chard, cone
24"x16' Schumacher-Boye, cone
30"x14' Hamilton, cone

CIRCLE SHEARS
No. 34 Lennox Rotary Bevel Shear, cap. ¾"
Niagara Circle Shear, 16 ga. 13" throat
Quickwork Circle Shear, 20" throat, 18 ga.
No. 2 Southwark Rotary Shear, 30" throat, 8 ga.
Southwark Rotary Shear, 36" throat, ⅜" cap.
No. 258 2x14 Quickwork Rotary Shear, 30" throat, ⅛" cap.

SHEET METAL MACHINERY
McCabe Pneumatic Flanger, ½" cap.
Niles-Bement-Pond Flanger, 8'
Niles-Bement-Pond Flanger, 10'
No. 1 Campbell Nibbler, 3/16" cap.
No. 2 Campbell Nibbler, ⅜" cap.
No. 10A Quickwork Double Seamer
Magee Sheet Metal Wiring & Edging Machine, m.d.

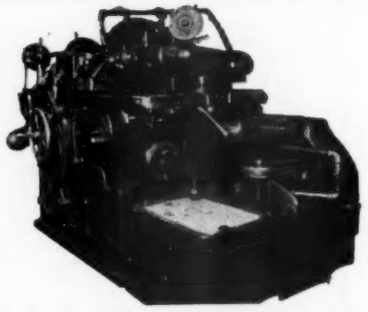
TAPPERS
No. 1, 2, 2X Garvin Automatic
Gaterman Oscillating Pneumatic
½" Rickert & Shaffer Vertical

Partial Listing only.
Send us your inquiries.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

GRINDERS
Landis 20x120 Plain, self-contained
Brown & Sharpe #14, 10"x48", Plain
Landis 10x36, Plain
Cincinnati 12x36 Plain, M.D.
Cincinnati Univ., Belt Drive, #2
Heald #216, 8" Rotary Ring Grinder, with Excello Spindle, Motor Drive.
Covel-Hanchett 40" Vertical Rotary Surface Grinder, Motor Drive.
Gardner #14 Double Opposed Disc. Grinder, BB
Gardner #8 Double End Ring & 40" disc Grinder, with Universal Tables.
Badger 12" Disc Grinder, Ball Bearing, double end, Universal Tables, belt drive.
#1—Iroquois Universal
#2—Norton Universal Tool & Cutter
#1—Le Blond Universal Tool & Cutter

CRANKSHAFT GRINDER
Landis 16"x72", complete with Universal Heads. Belt drive. Ser. No. 3483

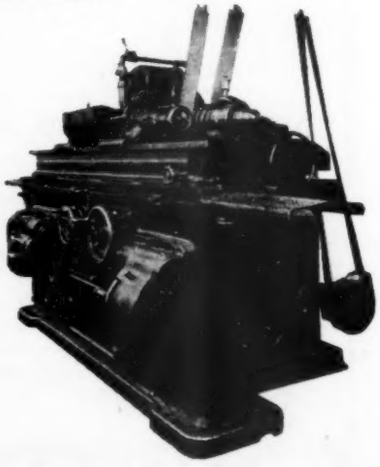


10 x 36 Landis Plain Grinder Self contained. Complete with Chuck. Back Rests and Centers.

LATHES

42"x25' PUTNAM Triple Geared, Screw Cutting Engine Lathe; Plain Change; Internal Geared, Face Plate Dr.

25" LeBlond, Heavy Duty, 12' bed
26" Greaves-Klusman, 16' bed
26" Crawford-Erie, 12' bed
22" American, 8' bed
20" Davis, 10' bed
20" Davis, 8' bed
18" Lodge & Shipley, 10' bed
18" Mueller, 8' bed
18" Chard, 8' bed
16" Lodge & Shipley, Grd. Hd., 6' bed
16" American, Grd. Hd. 6' bed
16" Reed, 6' bed
16" Reed-Prentice, 10' bed
17" Sidney, 8' bed
16" Pratt & Whitney, 6' bed
14" Lodge & Shipley, 6' bed
13" Pratt & Whitney, 6' bed
3½x48" Fitchburg Lo-swing Lathe
8x108 Lo-swing



1—#14 B&S CYLINDRICAL GRINDER —10" x 48" Belt Drive—Very fine condition, ready for immediate delivery.

DEPENDABLE MACHINES

"FALK" REBUILT MACHINERY

WIRE, WRITE OR PHONE

#14—THOMAS SPACING MACHINE
Complete with Tables—Now fitted as Plate Shear.
Capacity 42" wide 1¼ thick.

MILLING MACHINES

#2 B.S. Plain, Belt feed
#½ Van Norman Duplex
#0 Van Norman Duplex
#1—Cleveland Vertical (New)
#40 H Index Vertical (new)
#12—Pratt & Whitney Lincoln (4)
#4 Hendey Lincoln (2)
#13 Brown & Sharpe Prod.
#12—P.W. Duplex Lincoln
#2 Garvin Duplex Lincoln
#2 P. W. Hand Miller (6)
#4—Burke Bench
#1—Cincinnati Plain

RADIAL DRILLS

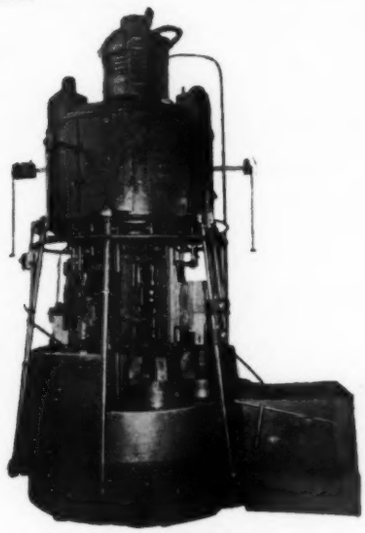
5 ft. American Radial Drill
4' Dresses Flat Col. SPD
3' Dresses Flat Col. Motorized-Rebuilt
3' Bickford

PLANERS

42"x36"x12' Cincinnati, two Heads, belt drive. Rebuilt.
28"x32"x8' Wilson, single head, M.D. Rebuilt
24" NILES-BEMENT-POND Planer-Shaper, Excellent for Die Blocks. Motor Drive.
48"x48"x16' Niles-Bement-Pond 4 Heads Belted Motor Drive.

14" BULLARD
BULLARD MULT-AU-MATICS

2 14' Bullard Mult-Au-Matic 6 Station, M.D.



SHAPERS

24" Stockbridge
20" Ohio
16" Smith & Mills
17" Smith & Mills
14" Gould & Eberhardt, High Duty
7" Rhodes with vertical head.
26" Niles-Bement-Pond, Motorized.
15" Smith & Mills Single Geared.
12" Gould & Eberhart.

GEAR GENERATORS

Gleason 15" Roughers, Serial Nos. 9230 and 6316
Gleason 15" Finishers, Serial Nos. 6129 and 3829

TURRET LATHES

24" Gisholt, 3⅜" hole
#2A W&S Universal, Chucking
#2A W&S Univ., Bar Feed
2¼x24" J&L
3x36" J&L
#1 W&S, ⅝" collet capacity
#2 W.S. G.F.H. Hollow Hex
#1 W.S. G.F.H. Hollow Hex
#2½ Garvin G.F.H. Tex Turret 1¼ Cap.

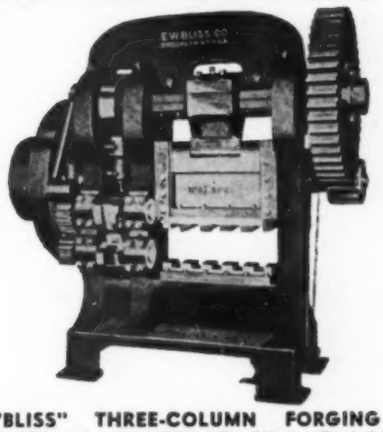
PRESSES AND SHEARS

No. 18 Bliss, OBI
No. 19 Bliss, OBI, 3
No. 19C Bliss, OBI
No. 20 Bliss, OBI (10)
No. 20B Bliss, OBI
No. 75 Toledo Plain
No. 75 Toledo Geared

PRESSES AND SHEARS
(Continued)

No. 3 Consolidated
No. 14 Stoll
No. 3 American Can Co., OBI
No. 3 Adriance
No. 3B Marquette Grd; M.D.
No. 702 Bliss Flat Trimming
No. 4 Bliss, Back Flywheel
No. 4 Baxendale (3) OBI
No. 6 Waterbury D.B. II
No. 3018 Bliss Auto. Gang Press
25-ton Henry & Wright
No. 93D Toledo S.S. Solid Frame Dble. crank; 4" stroke, grd.
No. 166 Consolidated Solid
73½ Bliss S.S.
#4 Waterbury Open Back Gap
#57½ Toledo S.S. 8" Stroke
#6 Waterbury Geared, O.B., Inclined
#15N Bliss BG. M.D.
#25N Bliss BG. M.D.
#25N Bliss M.D. Plain
#21N Bliss M.D., Plain
156"x⅜ Woodard Shears
120"x10 ga. Stoll Geared
72"x10 ga. Stoll (3)
72"x16 ga. Stoll, Gap
42"x⅜" Mesta, Gap, M.D.
40"x⅜" Mesta Gap, M.D.-2
36"x¼" Pittsburg Shear
36"x14 ga. Niagara Grd. M.D.

STAMCO PACK SHEAR
Consists of 2—12' x ⅜" Long Shear
2— 6' x ⅜" Long Shear
Adjustable Base—Rolls and Drive—
New 1928—BARGAIN



"BLISS" THREE-COLUMN FORGING PRESS, No. 4 With Positive Clutch Code Word, Realishad

This press as shown, has machine steel upper and lower die holders, and a crank on end of main shaft operates two sector gears attached to rocking die holders for rolling tapers on claw hammers and other similar work. Axes—spring leafs, etc.

PARTIAL LISTINGS ONLY—SEND US YOUR INQUIRIES

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

MOREY
DEPENDABLE
USED MACHINES

ROCKFORD #2 Horiz. Boring Mill—floor type—M.D.

P & W 6"x132" Thread Miller

AUTOMATIC MACH. CO. 12x4' Threading Lathe

McCABE 24"—42"x14' Double Spindle Lathe

LODGE & SHIPLEY 18x6', Q.C.G. Cone Drive Lathe

LeBLOND 20x10' Geared Head Lathe

FOSTER No. 1F Fastermatic Turret Lathe

NATCO No. 12 Multi-Spindle Drill

NATCO C-13 Hyd. Multiple Spindle Drill

COULTER 2 spindle Diamond Borer—M.D.

INGLE 12" Gear Tooth Rounders

B. & S. #4—48" Gear Cutter

GLEASON 24" Bevel Gear Planer

GLEASON 37" Bevel Gear Planer

GLEASON 6"-11"-18" Bevel Gear Generators

LEES BRADNER #5A Gear Generator

LANDIS 3½" Internal Hydraulic Race Grinder

LANDIS 12x120" Pl. Cyl. Grinder —M.D.

HEALD Nos. 60-65 Internal Grinders

NEW BRITAIN No. 22 Automatic Chucking Machine

CLEVELAND ⅜"-½" Model "B" Automatic Screw Machine

ESPEN LUCAS No. 138 Cold Saw —Cap. 12" Rd.

NEWTON No. 200 Cold Saw—Cap. 11" rd.

COCHRANE & BLY No. 5 and No. 6 Cold Saws

CLEVELAND No. 1 Plate Planer—21' capacity

GRAY 30"x30"x8' Planer — 2 heads on cross rail—M.D.

GRAY 30"x30"x8' Planer

ACME 1" All Steel Upsetter

AJAX 3" All Steel Upsetter

SAUNDERS 8"-18" Pipe Threader, M.D.

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your Specific Inquiries

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410 BROOME ST., NEW YORK

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-(ORIGINATED BY US)-
MACHINE TOOLS

Reg. U.S. Patent Office

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1 2 4 spdl. Henry & Wright
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
4 spdl. Sigourney
4 spdl. Woodward & Rogers
No. 1 Baush Multiple

GEAR CUTTERS
No. 4—48" Brown & Sharpe
No. 5—48" Brown & Sharpe
96" Newton Spur Gear

GRINDERS
Hill-Clarke Production Universal
12x36 12x50 12x72
(See page 124 special advertisement Hill-Clarke Cylindrical Grinders)
No. 40 Bryant Plain, Wide Wheel, Oscillating
No. 10 Lees-Bradner Spur Gear Grinder
No. 5 Springfield Planer Type Surface 1½" dia. New Yankee Drill Grinder

LATHES
No. 4 AC Leblond Auto. Duplex Crankshaft
18"x6' Bradford Geared Head
20"—40"x10' Rahn-Larmon Geared Head Sliding Bed Gap
26"x10' Bridgeford
30"x12' Whitcomb-Blaisdell

PLANERS
24"x24"x6' Powell
24"x24"x12' Gray
30"x30"x8' Powell
36"x36"x8' Cincinnati
36"x36x12' American, 2 Heads
36"x36"x18' Cincinnati

PRESSES
No. 303 Bliss Straight Sided
No. 42½ Pels Beam Shear

SHAPER
24" Smith & Mills

TURRET LATHES
24" Steinle, 6¼" H.S.

MISCELLANEOUS
No. 11 Cochrane-Bly Saw Sharpener
60" Quickwork Rotary Shear
No. 3-B J. N. Lapointe Broach
No. 4 J. N. La Pointe Broach
6" Saunders Pipe Machine
No. 12 Bignall & Keeler Pipe Machine
No. 4 Gateman Tapper
No. 1 Garvin Tapper

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. CHICAGO

1—No. 2 Brown & Sharpe Plain Mill, M.D.
1—No. 21 Brown & Sharpe Plain Mill, M.D.
1—Becker Hand Mill, M.D.
1—No. 6 Whitney Hand Mill, M.D.
1—No. 41 Natco Multiple St. Line Drill, M.D.
1—No. 2 Baush Multiple Drill, M.D.
1—No. 3 LaPointe Broach, Screw Type, M.D.
1—No. 62 Bliss Punch Press, M.D.
1—No. 15 Garvin Plain Mill, M.D.
1—No. 310 Baker Drill Press, M.D.
1—No. 12 Natco Multiple Drill, M.D.
2—15" Gleason Pinion Roughers
Your inquiries receive prompt attention

Central Machine Tool Corporation
Adams 1914
122-126 Nebraska Ave. Toledo, Ohio

AUTOMATICS, 1¼" Cleveland Model B. #34 New Britain Chucking Machine

GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin. to top of table 18", M.D.; 30" x 240" Landis Cylinder; 24" x 96" Landis Cylinder.

GEAR CUTTERS, 96" x 16" & 60" x 12" Gould & Eberhardt Spur (2); 11" Gleason Bevel Gear Generators (2).

KEYSEATERS, #3 Baker; #4 Mitts & Merrill; #6 Catlin, 40" stroke x 5" wide; #1 Davis.

DUPLEX MILLER, #3 Garvin, table 12" x 64", 60" feed, gear box, AC, M.D. June delivery.

ROSENKRANZ MACHINERY CO.
30 Church Street New York, N. Y.

Gear Cutters, Spur, 30", 36" & 40", M.D.
Gear Planers, Bevel, 36" & 54" Gleason, M.D.
Lathe, Geared Head, 27"x11' LeBlond, Hvy. Duty.
Grinder, Cyl. 18"x30"x96" Norton, M.D.
Planer, 36"x36"x10' American, 2 heads, M.D.
Slotter, 15" Dill, & 8" Betts, M.D.

LANG MACHINERY COMPANY
28th St. & A.V.R.R. Pittsburgh, Pa.

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

OTT MACHINERY SPECIALS

AUTOMATICS, B. S. #00 & 1 Cut off
AUTOMATICS, Cleveland ⅞—1 1/16" Model M
GRINDERS, B. & S. #16 Plain 10"x72"
GRINDERS, Landis 10x36" Hydraulic, M.D.
GRINDERS, Persons & Arter—16" Mag. Chuck, M.D.
LAPPER, Norton #15 Vertical, M.D.
MILLING MACHINES, Becker Vertical, #4B.
PLANERS, 44x44x18' Niles 4 heads
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #14 & 14½ Horning, M. D.
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

5—Watson-Stillman 200-ton Semi-Automatic Molding Presses.
1—Watson-Stillman 4-plunger Horizontal Pump, M. D.
1—No. 7 Oxygraph Gas Cutting Machine
1—No. 1 Bilton Automatic Gear Miller

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laureiton Road Rochester, N. Y.

Machine Shop for Sale
Located in Louisiana

10 Lathes, Boring Mill, Milling Machines, Cylindrical Grinders, Hydraulic Wheel Press, Chain Hoist, Small Tools, etc. All Motor Driven & modern machine tools.

Write **FS-246**, American Machinist
330 W. 42nd St., New York City

TOOLS FOR QUICK DELIVERY

BROACHES
Nos. 1, 3 and 4 Lapointe, screw type
No. 2 **Standard** screw press
No. 3 **Lapointe** double, screw type
No. 3L **Lapointe** hydraulic
2 ton **American** vertical

BULLDOZERS
Nos. 5, 6 and 29 **Williams & White**

GEAR CUTTERS
No. 3 **Barber Colman** hobber
Nos. 1 and 5A **Lees Bradner** hobber
36" & 48" **Brown & Sharpe** automatic spur
60" No. 5A **Cincinnati** automatic spur
No. 6 & 7 **Fellows** gear shapers
18" **Gleason** straight bevel
24" No. 3 **Adams Farwell** hobber
No. 36 BM **Gould & Eberhardt** adjustable angle 3 spindle bevel
Lipe 2 spindle chamferer
15" **Gleason** quenching press
National Tool Co. gear check

GRINDERS
No. 72 **Heald** sizematic internal
10"x20" **Landis** hydraulic
10"x24" & 12"x36" **Landis**
10"x36" **Norton**
18" No. 2 **Gardner** disc
24" No. 4 **Gardner** disc
18" **Gardner** semi automatic disc
24", No. 84 **Gardner** opposed disc
24", No. 221 **Hanchett** opposed disc
53", No. 24 **Gardner** disc
30"x4" **Ransom** elec. snagging
2¼ **Wilmarth & Morman** drill
2¾" **Oliver** drill
3" **Oliver** drill point thinner
Nos. 50 & 60 **Heald** cylinder
20"x50" safety surface
14" **Pratt & Whitney** B.B. vert. surf
Schaehardt & Shutte hob grinder
Gisholt tool grinder
24" **Ingersoll** cutter
No. 1 **Leblond** univ. tool & cutter
No. 1½ **Cincinnati** univ. tool & cutter
17"x36"-48" **Norton** hydraulic crank
84" **Diamond** face & edge
Pratt & Whitney worm or thread

MILLERS
No. 31 **De Vlieg** Supermil
No. 33 **Kempsmith Mfg.**
No. 6 **Whitney** hand
Kempsmith hand
No. 3½ **Fox** hand
No. 12 **Browne & Sharpe Mfg.**
12" plain and BC **Cincinnati Mfg.**
Hall planetary thread, type C.
No. 3C **Lees Bradner** thread
Nos. 1 & 1½ **Knight** vertical
Type AB **Becker** vertical
25" x 25" x 14' **Ingersoll** slab
Nos. 1 & 1A **Davis & Thompson** drum type duplex
Nos. 10 & 45 **Bilton** Productomatics
60" **Ingersoll** continuous rotary

PUNCHES
Type B **Williams White** universal ironworker
1¼" x 4, 12" throat **Cleveland** horizontal
1¼" x 1", No. 1½ **Long & Alstatter**, 12" throat
⅝" x ⅝", 26" throat **Rock River**
No. 54 **Beloit** combination

ROLLS
54" **McKay** 17 roll straightener
No. 1A **Ajax** taper forging

SWAGERS
No. 208 **Etna**
No. 6 **Langelier** with feeder

SHAPERS
16" **Walcott**
16" **Hendey**
22" **Ohio**
36" **Morton**
12" **Dill** slotter

TAPPERS
¼" **Bodina** automatic nut, hopper feed
⅜" **National** precision nut, hopper feed
⅝" **Rickert Shafer** horizontal
Nos. 1 & 2X **Garvin**
Natco 1 and 2 way lead screw

THREADERS
⅛" **Webster** ¾ **Perks** double
⅛" **Acme** double
⅜" **Economy**, hopper feed
1", 2" & 2½" **Landis** single
2" & 2½" **Landis** double
1½" **Geometric**
1½" **Rosaco** pipe machine

UPSETTERS
1¼" **American**
1½" **Acme**
2" **National**, extended ram guide
2½" **Ajax** twin geared, suspended slides
4" **Ajax** original model, single geared
4" **Ajax** twin geared, suspended slides

PRESSES
No. 21½ **Bliss** OBI geared
71 ton **Waterbury Farrell** OBI
No. 62 **Bliss** openback, 8" stroke
No. 76 **Toledo** openback
750 ton **Baldwin Southwark** hydraulic toggle, 11' 10½" between uprights, triple action
108", No. 796¼ **Toledo** double crank toggle drawing
48", No. 93½ **Toledo** double crank
28", No. 71 **Swaine** double crank
No. P2 **Ferracute** punching
No. 14½ **Toledo**, swing table
No. EL6 **Ferracute** straight side
No. 53 **Toledo** straight side
No. 4 **Massillon** straight side
No. 7 **Rockford** straight side
No. 8-7 **Zeh & Hahnemann** straight side
No. 2 **Standard**, screw type
4' x 3/16" series 40-4 **Cincinnati** press brake
Excelsior pick press

MILES MACHINERY CO. - - - Saginaw, Mich.

No. 3 Acme Universal Turret Lathe. Grd Head. Arranged for Chucking.
21" Model H Gisholt Turret Lathe.
14 ga x 8' OHL power Squaring Shear.
4 & 6 Spindle Avery Sensitive Drills No. 2 M.T., B.B.
No. 1B, No. 2B Edlund, 2 Spindle Sensitive Drills
16"x66" Landis Universal Grinder. Overhead belt drive
24"x24" Ohio Planer, 1 head, belted moto. drive.
18"x9' Chard Lathe semi quick change cone.
10' Robinson Toggle Type Press Brake
No. 12, 13 Natco Drills

IROQUOIS MACHINERY CO.
662 Ohio St. **Buffalo, N. Y.**

UNUSUAL VALUES

Shapers: 24" G&E.
28"x20'6" Rahn-Carpenter Lathe 14' between centers
24"x16' Greaves & Klusman
Briggs Type A Milling Machine
Presses: #48 Niagara, #16 J. M. Robinson ¼" capacity Rock River punch and shear
Broaching Machines, LaPointe, #1, #3
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
Ceiling Suspended Drill Unlimited drilling area
2 50# Bradley upright hammers, m.d. like new
Radial Drills: 5" Bausch
Miller: 20"x24"x18" Ingersoll
Grinders: #20 Bryant Internal
300 other machinery items
MOTORS—new 5 H.P. for 3-phase, ball brg. $55.75

Other sizes equally low priced. Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

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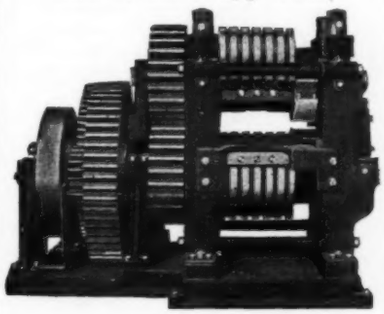

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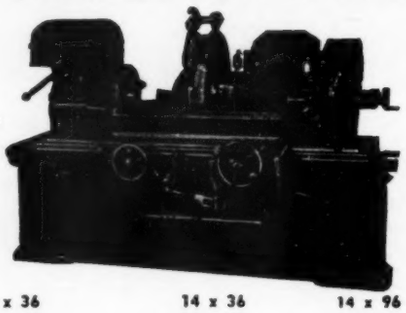

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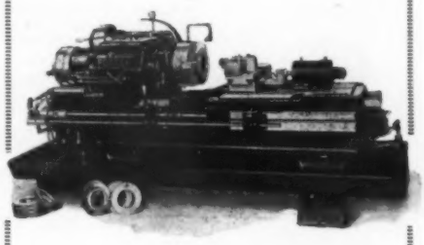

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920 Toledo Dbl. Crank Press
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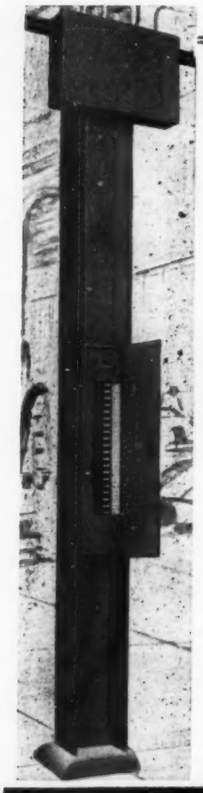

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(Illustrated at left: Cat. No. NAC1BC-3L1O—Column Type Panelboard, with Wire Duct and Pullbox)

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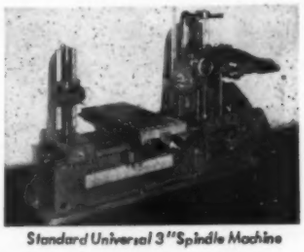

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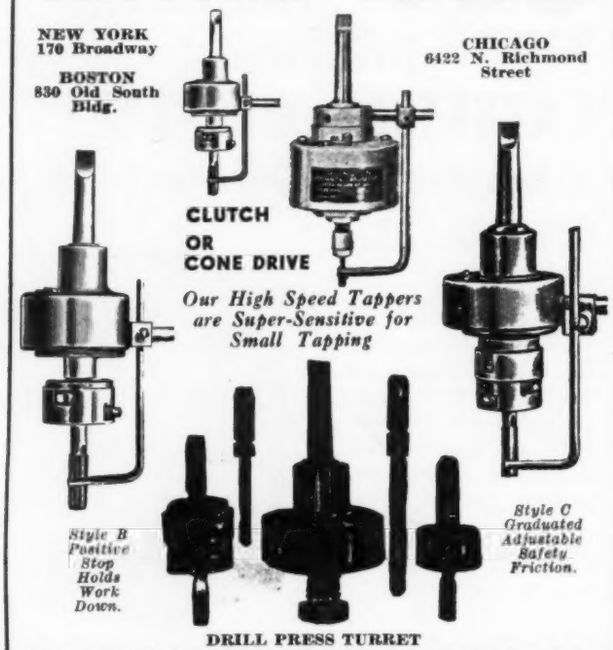

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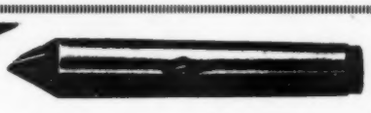

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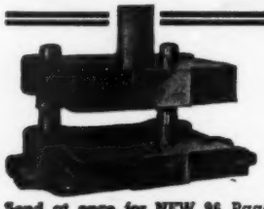

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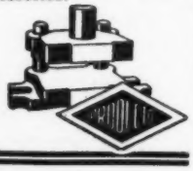

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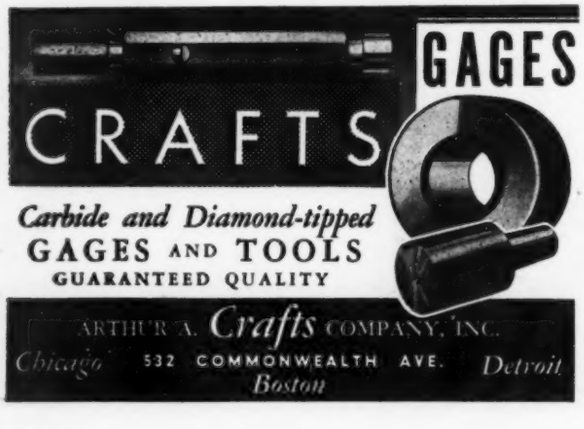

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Webber Gage Co., Cleveland.

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Jones & Lamson Mach. Co., Springfield, Vt.
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GAGES, Dial
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Taft-Peirce Mfg. Co., Woonsocket, R. I.

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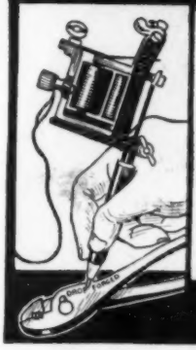

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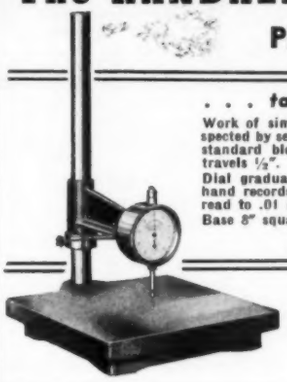

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Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".
Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.
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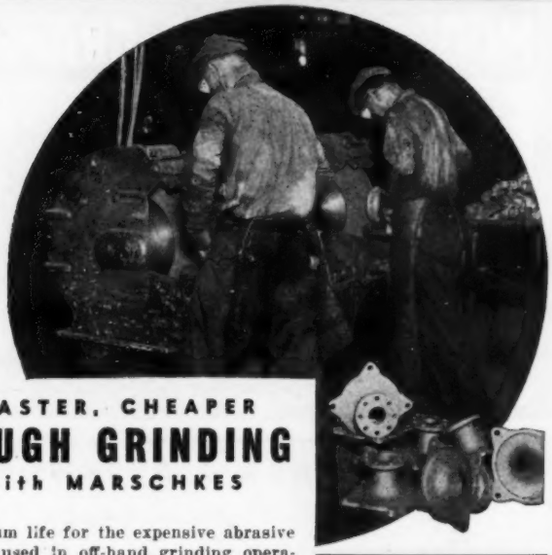

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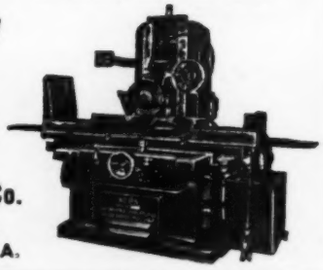

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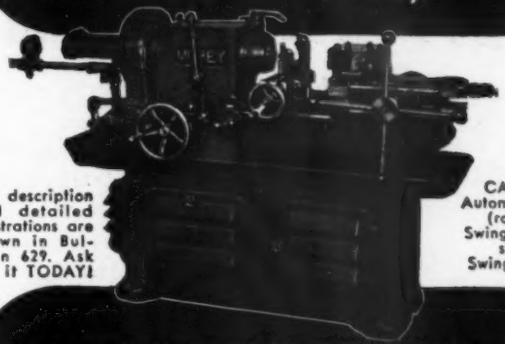

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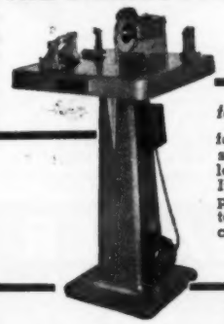

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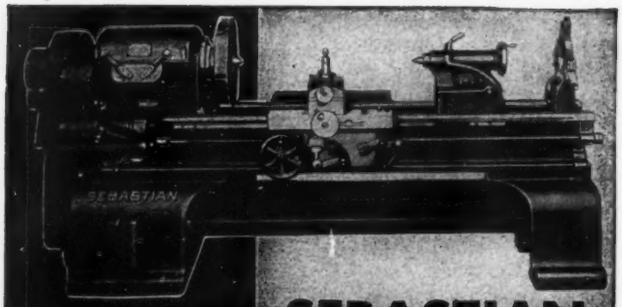

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14" to 20" Feeds
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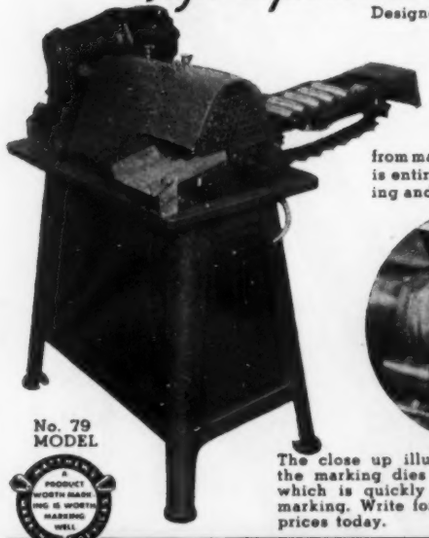
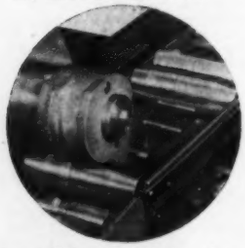
SHELL MARKING MACHINE
...for Marking 20MM to 155MM Shells

High Speed Production



Designed for high speed production marking, this machine is made in four sizes ... marks from 10 to 40 shells a minute, depending on size. Aside from manual feed, the machine is entirely automatic in marking and ejecting shells.



No. 79 MODEL

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General Electric Co., Nela Park, Cleveland, Ohio

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Cincinnati Grinders, Incorporated, Cincinnati, Ohio.

LAPS, Tool Makers
Producto Machine Co., Bridgeport, Conn.

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Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland, Ohio.

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LeBlond Machine Tool Co., R. K., Cincinnati, Ohio.
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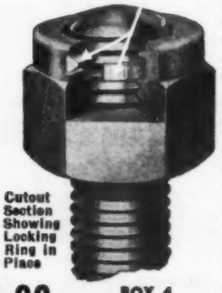

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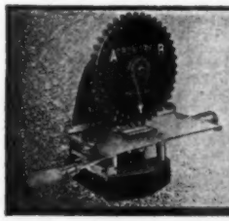

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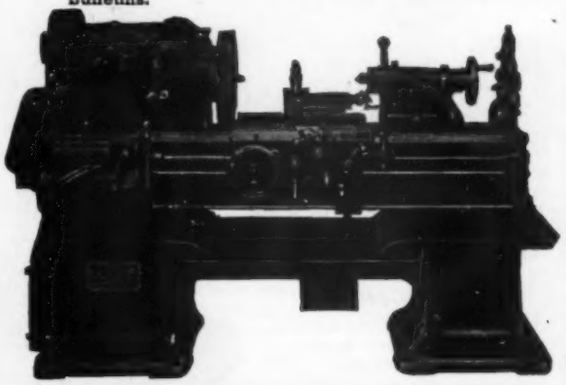

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. . . Put Your Small Work on a Production Basis!

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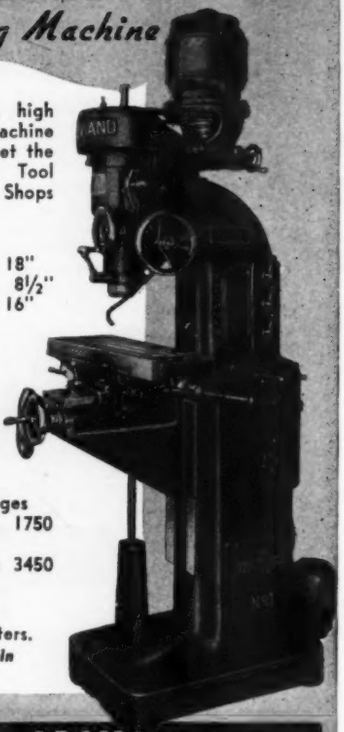

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Longitudinal Feed ..... 18"
Cross Travel ..... 8½"
Vertical Travel ..... 16"

Table

Working Surface—8"x32"
T-Slots—three 17/32", center to center 1⅞"

Table Feeds

Twelve ranging from .6" to 12½" per min.
Motor ⅓ H.P.
Spindle Speeds—Two Ranges
12 speeds 100 r.p.m. to 1750 r.p.m.
12 speeds 200 r.p.m. to 3450 r.p.m.

Cutter Capacity

1/16" to 2½" milling cutters.

Full descriptive bulletin upon request.

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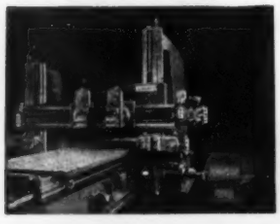

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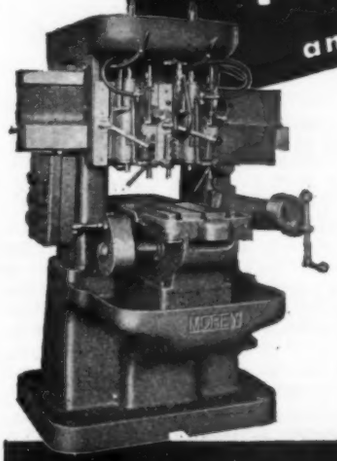

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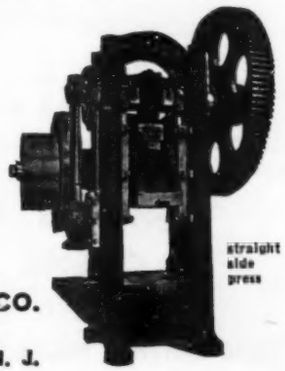

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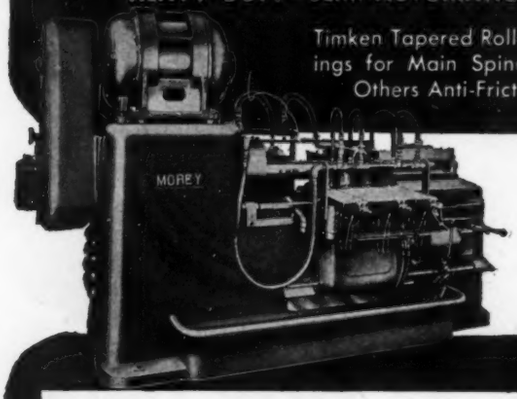

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Rigid enough to use carbide tools to their full capacity.

This lathe is entirely self-contained—no outside or auxiliary equipment required.

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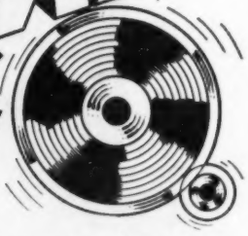

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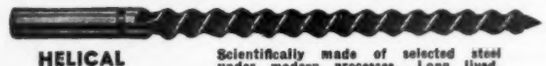

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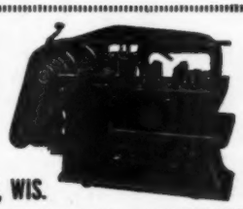

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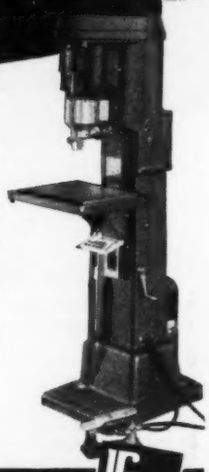

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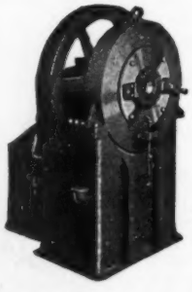

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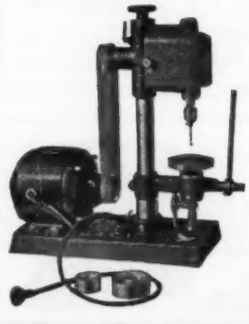

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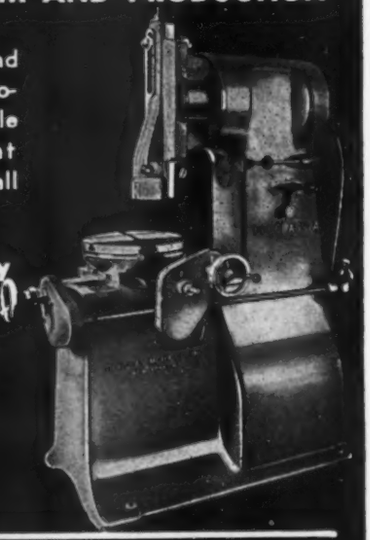

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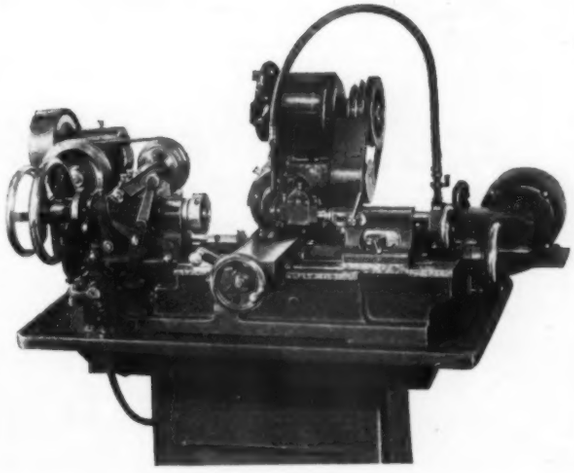

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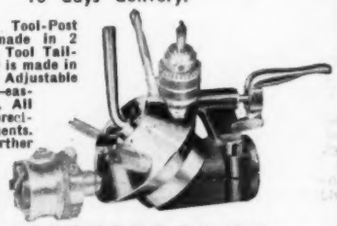

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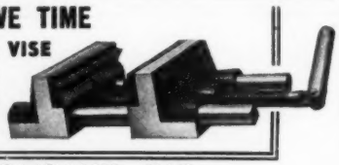

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New Britain-Gridley Machine Co., New Britain, Conn.

VISES, Drilling Machine
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Fenn Mfg. Co., Hartford, Conn.
Hartford Special Mchy. Co., Hartford, Conn.
Johnson Tool Co., East Providence, R. I.
Sheldon Machine Co., Chicago.

VISES, Machine
Armstrong-Blum Mfg. Co., Chicago, Ill.
Fenn Mfg. Co., Hartford, Conn.

VISES, Machinist
Desmond-Stephan Mfg. Co., Urbana, Ohio

VISES, Milling Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., The Cincinnati, Ohio
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Mchy. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Machine Co., Chicago.

VISES, Pipe
Armstrong Bros. Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

WASHING MACHINES, Metal
Barrett Co., Leon J., Worcester, Mass.

WELDERS, Arc
Hobart Brothers, Troy, Ohio

WELDING ELECTRODES
General Electric Co., Schenectady, N. Y.

WELDING MACHINES, Electric Arc
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WIRE STRAIGHTENING & CUTTING OFF MACHINES
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WORM DRIVES
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Michigan Tool Co., Detroit.
Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.

WORM GEARS
Michigan Tool Co., Detroit, Mich.

WORMS
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WRENCHES, Machinist
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WRENCHES, Pipe
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Armstrong Bros. Tool Co., Chicago, Ill.

WRENCHES, Tap
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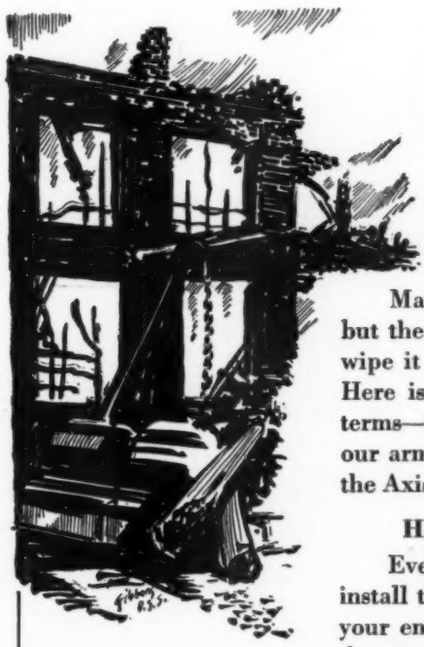

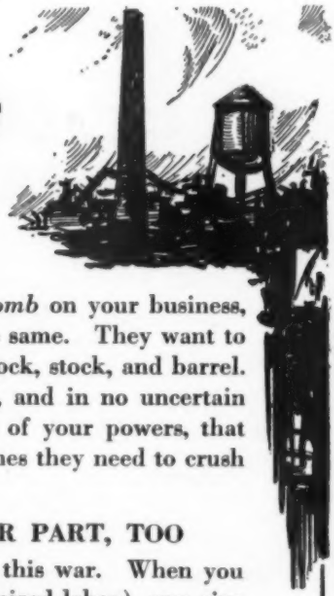

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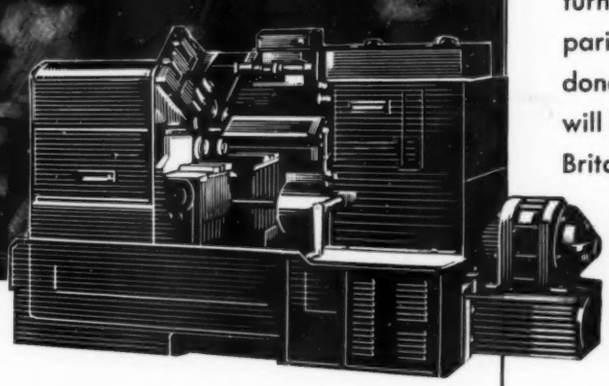
IT TAKES MACHINES TO BUILD MACHINES

To create a vast army of tanks in a matter of months, industry must have new regiments of screw machines and chuckers. And they must be as efficient as the equipment they help to make.

The rate at which New Britain Automatics are being turned out is so far beyond previous records that comparison is pointless . . . and everything possible is being done to increase that pace still further. Every machine will have the famous *extra performance* for which New Britains are noted, and which is so much needed today.



A complete line of Multiple Spindle Screw Machines up to 2¼" Capacity. Also a complete line of Chuckers . . . Four, Six and Eight Spindles to 10¼" Capacity.

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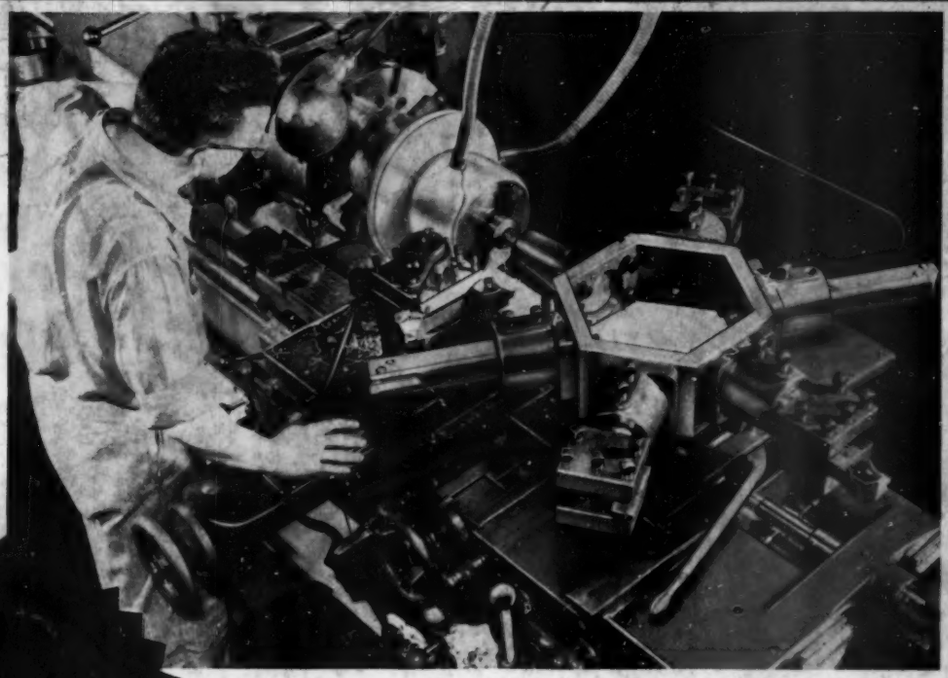

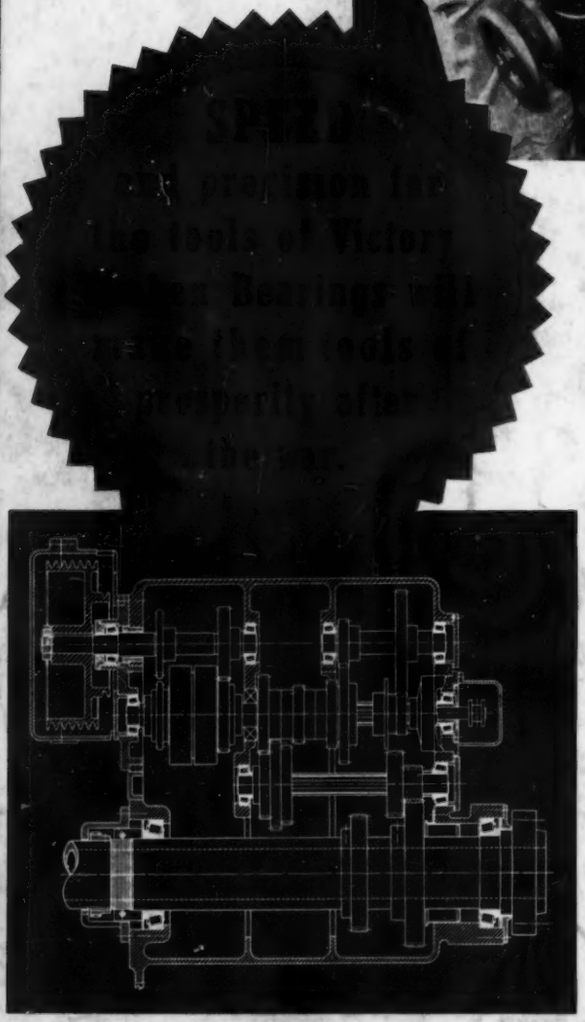

Headstock of the Gisholt 2L High Production Turret Lathe showing the application of Timken Bearings on spindle and other shafts.

Heavy duty machine tools equipped with Timken Bearings form the backbone of American Victory production. They include lathes, milling machines, grinders, drilling machines, boring machines, gear hobbers, and specialized equipment of many different kinds.

The Gisholt 2L High Production Turret Lathe shown in the photograph is a good example of the speed and precision resulting from the use of Timken Tapered Roller Bearings.

When the photograph was taken, the lathe was machining wheel hubs of high carbon cast steel to a tolerance of .0005". With a cross-feeding hexagon turret and Gisholt standard tools it finishes two wheel hubs in the time previously necessary for machining one. Furthermore, many dimensions are held to even closer tolerances than are specified or were possible with the old method.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.